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Thermophysical Properties of Normal Butane from 135 to 700 K at Pressures to 70 MPa

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THERMOPHYSICAL PROPERTIES OF NORMAL BUTANE FROM 135 TO 700 K AT PRESSURES TO 70 MPa

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Using a modified version of the nonanalytic equation of state, thermophysical properties of normal butane are derived from physical properties data and are tabulated at integral temperatures from 135 to 700 K along isobars at pressures to 70 MPa. These isobar tables, along with a table for the saturated liquid, give values for densities, compressibility factors, internal energies, enthalpies, entropies, heat capacities, fugacities, sound velocities, dielectric constants, and isochore and isotherm derivatives. Equations, whose coefficients are determined from a least squares fit to selected experimental data, are also presented for vapor pressures, orthobaric liquid and vapor densities, ideal gas properties, second virial coefficients, dielectric constants, heats of vaporization, melting pressures, and orthobaric liquid specific heats, enthalpies, and entropies. Comparisons between experimental and calculated values for all properties considered here are reported in detail.

Key words: Densities; dielectric constants; enthalpies; entropies; equation of state; fugacities; internal energies; isobars; isochores; isotherms; Joule-Thomson inversion; latent heats of vaporization; melting line; normal butane; orthobaric densities; specific heats; vapor pressures; velocities of sound.

1. Introduction

The present work is a revision and extension of a previous provisional report [28] from this laboratory. Since that report new compressibility data [35] for normal butane at low temperatures have become available and are incorporated in the work reported here. These new data cover a range from 140 to 300 K at pressures to 35 MPa. As a result of new dielectric constant measurements [35,38] on normal butane, the present work also includes a correlation of dielectric constant data. The nonanalytic equation of state used here, which is modified from earlier versions [26-29], is also currently being employed in correlations for propane [30] and isobutane [31].

Other correlations on normal butane have been reported by Hanson [34], Prengle, et al. [57], Canjar, et al. [9], Das and Kuloor [20], and Das, et al. [21]. Many new properties data, especially at low temperatures, have appeared since these correlations were developed.

SI units are used throughout this report in tables and equations. Pressures are given in MPa, densities in kg/m^3, and temperatures in K. For thermal properties, the mol is used for amounts of substance. However, all computations in computer programs (Appendix E) for the present work have been conducted in units of bar for pressure and mol/L for density.

Symbols and units used in this report and in computations appear in Appendix A; conversion factors for units are given in Appendix B. Fixed-point values of normal butane used in this work are reported in Appendix C. A collection of references for the major physical properties of normal butane, along with ranges of data, is presented in Appendix D. Appendix E consists of computer programs used for the calculation of thermophysical properties of normal butane. In figure 1 is presented the density-temperature diagram for normal butane.

2. Physical Properties and Their Formulation

In this section, first the fixed-point values selected in present work are presented and their origins are briefly discussed. As the present equation of state originates on a given liquid-vapor coexistence boundary, the P(T) melting line, the vapor pressures, and the orthobaric densities are next formulated. Then the truncated virial equation of state is given because it is used to derive some needed data. The equation of state description is followed by formulation of some thermal properties needed for the final computations of a thermodynamic network. All symbols used in the equations are defined in Appendix A.

2.1 Fixed-Point Values

These values are listed in Appendix C.

(a) The Triple Point. The temperature (T_t = 134.86 K) is adopted from Das, et al. [21], while the pressure is determined from the vapor pressure equation (eq (2)). The liquid density is based on consistency with data in eq (3). Equation (4) for saturated vapor densities is used for calculating the vapor density.

(b) The Boiling Point. The temperature (T_b = 272.638 K) is from vapor pressure eq (2) at a pressure of 1 atm = 0.101325 MPa. Liquid and vapor densities are from eqs (3) and (4).

(c) The Critical Point. The temperature (T_c = 425.16 K) is adopted from Das, et al. [21] and is in agreement within acceptable limits with the values of Beattie, et al. [2] and Kay [44]. The density and pressure (ρ_c = 227.85 kg/m^3 (3.92 mol/L) and P_c = 3.7960 MPa) are adopted on the basis of fitting orthobaric densities, vapor pressures, and P-ρ-T data and then examining the behavior of the calculated critical isotherm. The selected values for density and pressure are substantiated by those obtained experimentally from the data of Kay [44], Beattie, et al. [2] and by those selected in the correlation of Das, et al. [21].

2.2 Melting Line and Vapor Pressures

(a) The Melting Line. Experimental pressures from about two to ten kilobars were reported by Reeves, et al. [59] as constants for the Simon eq (1). In present work using the triple point temperature and pressure from Appendix C, the relation,

$$P_m = P_t + P_o [(T/T_t)^c - 1] \quad , \qquad (1)$$

is obtained, where P_t = 6.7358 x 10^{-7} MPa, T_t = 134.86 K, P_o = 363.4 MPa, and c = 2.21.

(b) The Vapor Pressures. Data used for adjusting eq (2) appear in the first part of table 1. Other data, weighted zero, appear in the continuation of the table. Values at ID = 40 have been derived via thermal loops, as described by Goodwin [27], by use of the saturated liquid specific heat data of Aston, et al. [1] from the triple- to the normal boiling-point; the heat of vaporization of Aston, et al. [1] at the normal boiling point; the ideal gas thermofunctions formulated in section 2.6; the virial equation formulated in section 2.4; and, for the minor contribution of V•dP to ΔH on the saturated liquid path, the preliminary vapor pressure and saturated liquid densities equations were also used. This procedure also has been described by Yarbrough and Tsai [75].

The argument for eq (2) is $T_r \equiv T/T_c$; then, vapor pressures (P_σ) in MPa are given by the relation,

$$\ell n(P_\sigma \cdot 10) = a/T_r + b + c \cdot T_r + d \cdot T_r^2 + e \cdot T_r^3 + f \cdot (1 - T_r)^\varepsilon \quad , \qquad (2)$$

where $\varepsilon = 1.85$ and, from least squares analysis,

a =	- 9.5092 4729	d =	4.8614 7936
b =	5.2015 3488	e =	- 7.5581 8629
c =	10.6409 5231	f =	18.7288 6023

Exponent ε was selected for a best fit of P-ρ-T data under the constraint that, at the critical point, the slope of the vapor-pressure equation be equal to the slope of the critical isochore from the equation of state, $dP_\sigma/dT = (\partial P/\partial T)_{\rho_c}$. The fit of present vapor pressure data is relatively insensitive to values of ε in the range, $1.1 \leq \varepsilon \leq 1.95$, but the critical point slope is dependent on the value of ε. The value of $\varepsilon = 1.85$ is consistent with scaling law equations. The present slope at the critical point is $dP_\sigma/dT = 0.064272$ MPa/K.

2.3 The Orthobaric Densities

(a) Saturated Liquid Densities. Data in table 2 have been selected for consistency. Data weighted zero, which appear in the continuation of the table, are shown for comparison. If the variable for eq (3) is defined by

$$x(T) \equiv (T_c - T)/(T_c - T_t) \quad ,$$

then the orthobaric liquid densities, ρ_ℓ, are described by

$$(\rho_\ell - \rho_c)/(\rho_t - \rho_c) = x + (x^\varepsilon - x) \cdot [a + b \cdot x + c \cdot x^2] \quad , \qquad (3)$$

where $\varepsilon = 0.35$, and, from least squares analysis,

a =	0.7943 88335	c =	-0.0858 29197
b =	-0.0010 89476		

(b) Saturated Vapor Densities. The following new type of formulation for saturated vapor densities has been developed for consistency with the equation of state (eq (6)) to yield a compressibility factor approaching unity in the limit of low densities, as described earlier [26,29]. Data in table 3 used in the fit have been selected for internal consistency. Values at ID = 40 are derived from the vapor-pressure and virial equations. Other data, weighted zero, appear in the continuation of table 3. The compressibility factor for saturated vapor is formulated by use of the vapor-pressure equation, such that $Z_\sigma(T)$ approaches

unity as $\rho_g \rightarrow 0$, (hence $T_\sigma(\rho) \rightarrow 0$). Let $A_o \equiv (Z_c - 1)$, where Z_c is value of the compressibility factor at the critical point, and define the arguments

$$\Pi(T) \equiv P_\sigma(T)/P_c \ , \qquad T_r \equiv T/T_c \ , \qquad u(T) \equiv (1 - T_r) \ .$$

The saturated vapor densities, $\rho_g \equiv P_\sigma/(Z_\sigma \cdot R \cdot T)$, then are given by

$$Z = 1 + A_o \cdot \Pi \cdot T_r^{-2} \cdot f(T) \ , \tag{4}$$

where

$$f(T) \equiv 1 + a \cdot u^\varepsilon + b \cdot u + c \cdot \exp[\eta \cdot (1 - 1/u)] \ ,$$

$\varepsilon = 0.35$, $\eta = 2.3$, and, from least squares analysis,

$a = -0.8665\ 77289$ $\qquad$ $c = 4.4986\ 58942$

$b = 1.1203\ 97967$

The next-to-last column in table 3 gives the experimental residuals,

$$F(Z) \equiv (Z_{exp} - 1) \cdot T_r^2/[A_o \cdot \Pi] \ ,$$

used to develop a functional form for f(T).

2.4 The Virial Equation

For the truncated virial equation,

$$Pv/RT = 1 + B_r(T) \cdot \rho_r + \ldots \ , \tag{5a}$$

the second virial coefficient, $B_r(T)$, is dimensionless through the use of the reduced variables, $\rho_r \equiv \rho/\rho_c$ and $T_r \equiv T/T_c$. The following relation,

$$B_r(T) = B_1 + B_2/T_r + B_3/T_r^3 \ , \tag{5b}$$

is used to fit the second virial data given in the first part of table 4. Excluded data, weighted zero, appear at the end of table 4. From least squares analysis, the following coefficients,

$B_1 = 0.3703\ 0532$ $\qquad$ $B_3 = -0.6660\ 5953$

$B_2 = -0.9668\ 8512$

have been determined. The second virials have been used to synthesize P-ρ-T data, to calculate saturated vapor densities via the vapor pressure equation, and to make thermal loop computations.

2.5 The Equation of State

Figure 2 shows the P-T regions covered by P-ρ-T data of Beattie, et al. [2], Kay [44], Olds, et al. [51], and Haynes [35]. The data of Sage, et al. [64] are excluded from this figure and are not used in the fit, since they are superseded by data of Olds, et al. [51]. These P-ρ-T data for normal butane are also summarized in Appendix D and table 7. Data from the virial equation along a low density isochore are included in the fit. Equal weightings of unity have been given to the data sets [2,35,44,51] used in fit.

The nonanalytic equation of state used here originates on the liquid vapor coexistence boundary, as described in detail by Goodwin [26,29]. Twelve least squares coefficients appear in the vapor pressure and orthobaric density equations. In the equation of state there are four nonlinear parameters and only three least squares coefficients, as described below. The equation has been modified from earlier forms [26-29]. For any density (isochore) the coexistence temperature, $T_\sigma(\rho)$, is obtained by iteration from eqs (3) and (4) for the orthobaric densities. The vapor pressure, $P_\sigma[T_\sigma(\rho)]$, thus is a function of density, and the equation of state has the form,

$$P - P_\sigma(\rho) = \rho_r \cdot R^* \cdot [T - T_\sigma(\rho)] + \rho_r^2 R^* T_c \cdot F(\rho,T) \quad , \tag{6}$$

where

$$F(\rho,T) \equiv B(\rho)\cdot\Phi(\rho,T) + C(\rho)\cdot\Psi(\rho,T) \quad . \tag{6a}$$

The density, $\rho_r \equiv \rho/\rho_c$, is reduced at the critical point, while the constant R^* is defined by $R^* \equiv (0.0083145)\cdot\rho_c$, MPa/K.

The temperature-dependent functions in (6a) are defined as follows.

$$\Phi(\rho,T) \equiv T_r^\beta \cdot \exp[b\cdot(1 - T_\sigma/T)] - (T_\sigma)_r^\beta \quad , \tag{6b}$$

where $b \equiv (1 - \beta) + (1 - \beta)^{1/2}$, $T_r \equiv T/T_c$, and $(T_\sigma)_r \equiv T_\sigma(\rho)/T_c$.

$$\Psi(\rho,T) \equiv \psi(\rho,T)/\psi_\sigma(\rho) - 1 \quad , \tag{6c}$$

where $\psi_\sigma(\rho)$ is obtained from $\psi(\rho,T)$ merely by replacing T with $T_\sigma(\rho)$, and

$$\psi(\rho,T) \equiv 1 - (\omega - \omega^\eta/\eta)/(1 - 1/\eta) \quad . \tag{6d}$$

The value for β was found by trial, while the value for η was determined from critical region behavior.

$$\omega(\rho,T) \equiv [1 - \theta(\rho)/T] \quad , \tag{6e}$$

where $\theta(\rho)$ is a locus of temperatures inside the coexistence envelope defined by

$$\theta(\rho) \equiv T_\sigma(\rho)\cdot\exp[-\alpha\cdot f(\rho)] \quad ,$$

and (6f)

$$f(\rho) \equiv |\rho_r - 1|^3/((\rho_t)_r - 1)^3 \quad .$$

$(\rho_t)_r \equiv \rho_t/\rho_c$ is the reduced density at the liquid triple point. The parameter α is found by trial.

The density-dependent coefficients in (6a) are

$$B(\rho) \equiv B_1 + B_2\cdot\rho_r^2 \tag{6g}$$

and

$$C(\rho) \equiv C_1\cdot(\rho_r - 1)\cdot(\rho_r - C_0)\cdot\exp[-\gamma\cdot\rho_r^2] \quad , \tag{6h}$$

where C_0 and γ are to be found by trial.

Parameters and coefficients of eq (6) for normal butane are

$\alpha = 1$, $\beta = 0.70$, $\gamma = 0.14$, $\eta = 1.1$,

$B_1 = 0.4565\ 5869\ 162$ $\quad$ $C_0 = 2.2$

$B_2 = 0.1714\ 3942\ 370$ $\quad$ $C_1 = -0.2803\ 6114\ 629$

Table 5 gives behavior of coefficients $B(\rho)$, $C(\rho)$ as a function of density and table 6 gives behavior along the critical isotherm. (In table 6, the symbol, $\rho_{r,t}$, is defined as the density reduced by the triple point density.) These tables show that the equation is smooth and well-behaved. Table 7 summarizes experimental compressibility data and presents deviations of experimental densities and pressures from values calculated from the equation of state. Although the data of Sage, et al. [64] are not used in the fit, comparisons with these data are presented in table 7. These data show systematic differences of approximately 1 percent when compared in regions of overlap with the results of Kay [44], Olds, et al. [51], and Haynes [35].

For normal butane, there are four comprehensive sets of liquid and gaseous compressibility data covering a temperature range from 140 to 600 K at pressures

as high as 70 MPa that are internally consistent within a few tenths percent in regions of overlap. Using these data sets, the present equation yields a slightly better fit than that obtained from a slightly different equation used in the provisional work [28] for which the low temperature data were not available. In the earlier work, the single phase results at temperatures less than room temperature were obtained by extrapolation. Thus, a significant improvement has been made in the P-ρ-T behavior of normal butane at low temperatures.

It should be noted that the functional form of the equation of state used here for normal butane has also been used in current work for propane [30] and isobutane [31]. Identical nonlinear parameters except for insignificant differences in γ, have been obtained for all three fluids in fitting this equation to available P-ρ-T data.

2.6 The Ideal Gas Functions

A formulation of the spectroscopic specific heats, $C_p^o(T)$, of Chen, et al. [12] has been developed. Using $x_o \equiv T/100$,

$$C_p^o/R - 4 = \exp(-\varepsilon/x_o) \cdot \sum_{i=1}^{5} A_i \cdot x_o^{1-i} , \qquad (7)$$

where $R \equiv 8.31434$ J/(mol·K) and

ε	=	2.37	A_3	=	257.279067
A_1	=	41.110973	A_4	=	-170.730596
A_2	=	-139.304011	A_5	=	40.032171

Table 8 shows the fit of data used. In this table, the values for $(H^o-H_o^o)$ and for S^o are obtained by numerical integration, starting at T = 300 K. Table 9 gives interpolated values at integral temperatures.

2.7 Thermal Loop Computations

At temperatures from the triple- to the normal boiling-point, new data have been derived for vapor pressures, saturated vapor densities, and for heats of vaporization by thermal loop computations for ΔH and for ΔS of saturated vapor and saturated liquid. This procedure described by Goodwin [29], and more generally by Yarbrough and Tsai [75] uses virial eq (5a), ideal gas functions eq (7), the heat of vaporization of Aston, et al. [1] at the normal boiling point, and the following new formulation of the specific heats of Aston,

et al. [1] for the saturated liquid from the triple- to the normal boiling-point. Define $x_o(T) \equiv T/100$; then the saturated liquid specific heats, $C_\sigma(T)$, in J/(mol•K), are given by

$$C_\sigma(T) = a/x_o + b + c \cdot x_o + d \cdot x_o^2 \quad , \tag{8}$$

where, from least squares analysis, the coefficients, in units of J/(mol•K), are as follows:

a =	-104.7430	c =	-97.2492
b =	284.0264	d =	20.6032

Results for the vapor pressures appear in table 1 at ID = 80, and for the heats of vaporization in table 10 at ID = 80. Saturated vapor densities from the thermal loop computations are replaced in table 3 at ID = 40 by derived data from the fitted vapor-pressure eq (2) and the virial eq (5a).

2.8 The Heats of Vaporization

Table 10 shows the fit of selected data. Those at ID = 80 are derived via thermal loops (section 2.7). Those at ID = 41 are from the Clapeyron equation. The formulation of these heat of vaporization (Q_{vap}) data in kJ/mol uses argument $x(T) \equiv (T_c - T)/(T_c - T_t)$;

$$Q_{vap} = A_1 \cdot x + (x^\varepsilon - x) \cdot [A_2 + A_3 \cdot x + A_4 \cdot x^2] \quad , \tag{9}$$

where

ε =	0.34	A_3 =	12.710873
A_1 =	28.789248	A_4 =	-16.533537
A_2 =	24.163103		

The coefficients have units of kJ/mol. The uncertainty of at least one percent in Q_{vap} at the higher temperatures will affect compressed liquid thermofunctions in this region, since Q_{vap} is used to compute across the "dome."

2.9 Saturated Liquid Enthalpies and Entropies

Data for saturated liquid enthalpies and entropies have been derived at temperatures from the triple- to the critical-point by use of the ideal gas functions, the equation of state, and the formulated heats of vaporization. The enthalpies then have been formulated, as shown in table 11. Define the variable,

$$x \equiv (T_c - T)/(T_c - T_t) \quad ;$$

then the enthalpies, $H_\sigma(T)$, are described in J/mol by

$$(H_\sigma - H_c)/(H_t - H_c) = x + (x^\varepsilon - x)\cdot \sum_{i=1}^{8} A_i \cdot x^{i-1} \quad , \qquad (10)$$

where $\varepsilon = 0.29$, $H_t = 0.001$ J/mol, $H_c = 45399.788$ J/mol, and

A_1	=	0.1929 77338	A_5	=	2.8727 89244
A_2	=	0.3998 98449	A_6	=	-4.0526 10155
A_3	=	-0.0549 93612	A_7	=	2.6963 77850
A_4	=	-1.0205 68625	A_8	=	-0.6834 38899

The formulation of saturated liquid entropies in J/(mol•K) is shown in table 12. Let $x \equiv (T_c - T)/(T_c - T_t)$; then the entropies, $S_\sigma(T)$, are given in J/(mol•K) by

$$(S_\sigma - S_c)/(S_t - S_c) = x + (x^\varepsilon - x)\cdot \sum_{i=1}^{6} A_i \cdot x^{i-1} \qquad (11)$$

where $\varepsilon = 0.23$, $S_t = 133.54372$ J/(mol•K), $S_c = 297.64652$ J/(mol•K), and

A_1	=	0.08883 44435	A_4	=	-0.95683 28496
A_2	=	-0.34703 04947	A_5	=	0.95799 92545
A_3	=	0.20937 24392	A_6	=	-0.65346 07056

Specific heats along the saturated liquid path follow from the relation, $C_\sigma(T) = T\cdot dS_\sigma/dT$, and are given in the last column of table 12. All of the above saturated liquid formulations for $H_\sigma(T)$, $S_\sigma(T)$, and $C_\sigma(T)$ are used to compute thermodynamic properties for compressed liquid states at $T < T_c$.

2.10 Dielectric Constants

Dielectric constants, ε, for the saturated vapor of normal butane are estimated from the refractive indices, n, of Sliwinski [67] via $\varepsilon = n^2$. (These low density data are in a region for which dispersion effects should be minimal.) Haynes [35,38] recently has measured ε for the saturated liquid at temperatures from 135-300 K and for the compressed liquid at presures to 35 MPa along isotherms up to 300 K. These data and their formulation via the Clausius-Mossotti function,

$$CMF \equiv [(\varepsilon - 1)/(\varepsilon + 2)]/\rho \quad , \tag{12a}$$

are presented in table 13. The following formulation has been used to fit the data in table 13 and to calculate ε along isobars (table 21) at temperatures extrapolated up to 450 K, and at pressures up to 70 MPa. Define the variables, $T_r \equiv T/T_c$ and $\rho_r \equiv \rho/\rho_c$; then, with P in units of MPa, the Clausius-Mossotti function, in units of cm^3/mol, is given by

$$CMF = A_1 + A_2 \cdot \rho_r + A_3 \cdot \rho_r^2 + A_4/T_r + A_5 \cdot P/10 \tag{12b}$$

where

A_1	= 20.654382	A_4	= -0.0392 1649
A_2	= 0.2512 9317	A_5	= -0.0116 4552
A_3	= -0.0972 3048		

The least squares coefficients have units of cm^3/mol. Data at high pressures have a diminished weighting as seen in table 13. The rms relative deviation for 152 points is 0.083 percent for the CMF and 0.017 percent for the dielectric constant.

Comparisons with dielectric constant data for liquid normal butane not used in the fit to eq (12) are not presented in table 13. The dielectric constants of Thompson and Miller [70] and Luo and Miller [47] at temperatures between 220 and 289 K agree within 0.1 percent with values calculated from eq (12).

3. Computational Methods

The numerical values for E and H in this report are based on the assigned value, E = 0 at the liquid triple-point, obtained by use of the arbitrary value, E_0^o = 22644.306 J/mol. Specific heats of Aston, et al. [1] could be integrated to give the solid at T = 0 as reference state.

3.1 The Homogeneous Domain

The homogeneous domain of figure 1 includes all regions which can be attained along isotherms starting at zero density without crossing the vapor-liquid "dome," and without passing very close to the critical point at $T > T_c$.

Computations start with ideal gas thermodynamic functions at zero density, and then continue by integrating numerically along isotherms by use of the equation of state in the following relations,

$$\Delta E = \int [P - T\cdot(\partial P/\partial T)]\cdot d\rho/\rho^2 \quad , \tag{13}$$

$$\Delta C_v = - T \cdot \int (\partial^2 P/\partial T^2)\cdot d\rho/\rho^2 \quad , \tag{14}$$

$$\Delta S = R\cdot \ell n[P^o/(\rho RT)] + \int_0^\rho [R - (\partial P/\partial T)/\rho]\cdot d\rho/\rho \quad . \tag{15}$$

Equation (15) is for use with initial entropies in hypothetical ideal gas states at P^o = 1 atm (0.101325 MPa). For all other initial states,

$$\Delta S = - \int (\partial P/\partial T)\cdot d\rho/\rho^2 \quad . \tag{15a}$$

In each (ρ,T) state, reached by above integrations, the following are computed,

$$H = E + P\cdot v \quad , \tag{16}$$

$$C_p = C_v + T\cdot(\partial P/\partial T)^2/(\partial P/\partial \rho)/\rho^2 \quad , \tag{17}$$

and

$$W^2 = C_p\cdot(\partial P/\partial \rho)/C_v \quad . \tag{18}$$

3.2 The Saturated Liquid

At temperatures from the triple-point to the critical-point, thermofunctions for the saturated vapor are obtained via eqs (13) through (16). Then eq (9) for the heat of vaporization, Q_{vap}, is used to compute

$$\Delta H = - Q \quad , \quad \Delta S = \Delta H/T \quad , \tag{19}$$

such that the free energy of vaporization, $\Delta G \equiv \Delta H - T\cdot\Delta S$, is zero (see section 2.9). Having obtained H and S for the saturated liquid, $E = H - P\cdot v$ is computed.

The single-phase specific heat, $C_v(\rho,T)$, at the saturated liquid boundary, is obtained from eq (11) using $C_\sigma(T) = T\cdot dS_\sigma/dT$ and the thermodynamic relation,

$$C_v(\rho,T) = C_\sigma(T) + T\cdot(\partial P/\partial T)\cdot(d\rho_\ell/dT)/\rho_\ell^2 \quad , \tag{20}$$

where ρ_ℓ is density of the saturated liquid. Values for $C_p(\rho,T)$ and $W(\rho,T)$ on this boundary follow from eqs (17) and (18). For liquid at the normal boiling point, the following values have been obtained,

T_b = 272.638 K, H_b = 16770.1 J/mol,
E_b = 16760.3 J/mol, S_b = 218.485 J/(mol·K).

3.3 The Compressed Liquid

Starting with above values for E, S, and C_v on the saturated liquid boundary, eqs (13), (14), and (15a) are used to integrate along isotherms, and then H, C_p, and W are obtained via eqs (16), (17), and (18).

3.4 Fugacity Coefficients

The fugacity coefficients in table 21 were computed along isotherms relative to properties in hypothetical ideal gas states at a pressure, P^o = 1 atm (0.101325 MPa),

$$(f/P) = (P^o/P)\cdot\exp[\Delta G/RT] \quad . \tag{21}$$

For any (P,T) point, the isothermal free energy change is

$$\Delta G = (H - E_o^o) - H^o - T\cdot(S - S^o) \quad , \tag{22}$$

in which the arbitrary value of E_o^o was added to tabulated values of H(P,T) such that E(P,T) = 0 for liquid at the triple point.

3.5 Simplified Computation

Given the subroutines of Appendix E, it is necessary first to call SUBROUTINE PVTDATA, to place constants in common statements. To obtain the density in mol/L at a given T,K and P,bar, it is necessary merely to write the instruction DEN = FINDENF(T,P) for single-phase domains. Coexisting densities are given by the functions DENGASF(T) and/or DENLIQF(T), and the vapor pressure in bar by PSATF(T).

For thermodynamic properties, the subroutine SIMPLE here is an example of how to use the general subroutine THERMO (see Appendix E).

4. Tests and Conclusions

In the provisional report [28], comparisons were made between enthalpy differences from that work and those from the correlation of Das, et al. [21]. Since the results from the present work are approximately equivalent to those from the earlier report at temperatures above 300 K, these comparisons, along with some consistency tests, are omitted in this report.

It has been a routine procedure to validate equation of state computations by comparing calculated and experimental specific heats and sound velocities. For normal butane, there are only a few experimental specific heats and sound velocities available, most of which are unreliable. Comparisons with available data are presented in tables 14-16.

In the present work, an isochoric, nonanalytic equation of state has been developed, based on thermophysical properties data, to compute thermodynamic properties of normal butane. This equation originates on the liquid-vapor coexistence boundary; approximately twelve constants are used in the vapor pressure and orthobaric density equations. The equation, as used here, has only three least squares coefficients and describes a $P(\rho,T)$ surface free of irregularities consistent with the known behavior of specific heats, especially in the critical region. Four nonlinear parameters appear in the equation.

For normal butane, the equation of state has been developed from comprehensive and consistent sets of vapor pressure, orthobaric vapor and liquid density, and compressibility data. In general, the experimental data for these properties over the range of this work are in relatively good shape except for low temperature vapor pressures and vapor densities for which values have been determined from thermal loop computations. However, as mentioned earlier, accurate specific heat and sound velocity data are needed for comparisons with computations from the equation of state.

5. Tables of Physical and Thermodynamic Properties

5.1 Calculated P-ρ-T Isochores and Isotherms

Tables 17 and 18 give a selection of isochores and isotherms computed by equation of state (6). These are essential to examine behavior of the $P(\rho,T)$ surface. They are a useful supplement to the isobars of table 21 for interpolating P-ρ-T values and their derivatives.

The tables of isochores show that the isochore curvatures are qualitatively consistent with a maximum in the specific heat $C_v(\rho,T)$ at the critical point. The isotherm tables show that $\partial P/\partial\rho$ is nonnegative and that pressure increases monotonically with density along isotherms.

5.2 The Joule-Thomson Inversion Locus

Table 19 gives the P-ρ-T locus of the JT inversion, $(\partial T/\partial P)_H = 0$, obtained from equation of state (6) under the condition, $T\cdot(\partial P/\partial T) = \rho\cdot(\partial P/\partial\rho)$.

This table has been computed to temperatures well above those of P-ρ-T data, to show approach to a maximum in P-T coordinates.

5.3 Thermophysical Properties of the Saturated Liquid

Table 20 gives physical and thermodynamic properties of the saturated liquid computed by methods of section 3. (Properties of the saturated vapor can be obtained from Table 21 from values given at the coexistence boundary for each isobar.)

5.4 Thermophysical Properties Along Selected Isobars

Table 21 gives physical and thermodynamic properties on isobars, computed by methods of section 3. These tables are extrapolated above the maximum temperature and pressure of P-ρ-T data used for adjusting the equation of state. Small discontinuities may be detected at T_c = 425.16 K along isobars at $P > P_c$ = 3.796 MPa due to a change in the paths of computation (section 3).

The first line of each table refers to freezing liquid on the P(T) melting line. Each table at $P < P_c$ contains a blank line for the transition from saturated liquid to vapor, as seen by the abrupt decrease of density. Dielectric constants are extrapolated above maximum experimental temperatures and pressures (see section 2.10 and table 13), but have not been extrapolated above 450 K.

6. Acknowledgments

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APPENDIX A. Symbols and Units

Subscripts c and t refer to critical and liquid triple points.

Subscripts g and ℓ refer to saturated vapor and liquid.

Subscript σ refers to liquid-vapor coexistence (usually the liquid).

Subscript r refers to reduced parameter.

Subscript o refers to reference state property.

Subscript m refers to melting line.

Subscript b refers to normal boiling point.

Superscript o refers to ideal gas state property.

expt refers to experimental value.

calc refers to calculated value.

$(\partial P/\partial T)_\rho$	isochore derivative, MPa/K
$(\partial P/\partial \rho)_T$	isotherm derivative, MPa•m^3/kg
$(\partial^2 P/\partial T^2)_\rho$	isochore curvature, MPa/K^2
α,β,γ,η	nonlinear parameters in the equation of state
a,b,c,d,e,f	coefficients defined in various equations
A_0	$Z_c - 1$ in saturated vapor density equation
A_i	coefficients defined in various equations
b	$(1 - \beta) + (1 - \beta)^{1/2}$ in equation of state
$B(\rho),C(\rho)$	density-dependent coefficients in the equation of state
$B(T),C(T)$	second and third virial coefficients
$B_r(T),C_r(T)$	reduced second and third virial coefficients
c	exponent in Simon equation
$C_v(\rho,T)$	molal heat capacity at constant volume, J/(mol•K)
$C_p(\rho,T)$	molal heat capacity at constant pressure, J/(mol•K)
$C_\sigma(T)$	molal heat capacity for saturated liquid, J/(mol•K)
CMF	Clausius-Mossotti function, cm^3/mol
$E(\rho,T)$	the internal energy, J/mol
E_0^o	22,644.306 J/mol (arbitrary)
ε	exponent in various equations
ε	dielectric constant
f/P	fugacity/pressure ratio
$f(\rho)$	used in definition of $\theta(\rho)$
$f(T)$	defined in saturated vapor density equation
$F(\rho,T)$	defined in the equation of state
$F(Z)$	defined in the saturated vapor density equation
$G(\rho,T)$	Gibbs free energy, J/mol
H_0^o	enthalpy for ideal gas state at T = 0

$H(\rho,T)$	the enthalpy, J/mol
J	the joule, 1 N•m
JT	Joule-Thomson
L	the liter, 10^{-3} m^3
mol	58.1243 grams of normal butane (C^{12} = 12 scale)
$\omega(\rho,T)$	defined in the equation of state
P	pressure, MPa
P_m	melting pressure, MPa
$P_\sigma(T)$	the vapor pressure, MPa
$P_\sigma(\rho)$	$P_\sigma[T_\sigma(\rho)]$, vapor pressure as a function of density
$\Pi(T)$	$P_\sigma(T)/P_c$
$\Phi(\rho,T)$	function in the equation of state
$\Psi(\rho,T)$	function in the equation of state
Q_{vap}	ΔH_{vap}, the heat of vaporization, J/mol
R[1]	the gas constant, 8.3145 J/(mol•K), 0.0083145 MPa•L/(mol•K)
R^*	$0.0083145 \cdot \rho_c$, MPa/K
ρ	density, kg/m^3
ρ_r	ρ/ρ_c, density reduced at the critical point
$\rho_{r,t}$	ρ/ρ_t, density reduced at the triple point
$S(\rho,T)$	the entropy, J/(mol•K)
T	temperature, K
T_o	constant
T_r	T/T_c, temperature reduced at the critical point
$T_\sigma(\rho)$	liquid-vapor coexistence temperature, K
$(T_\sigma)_r$	$T_\sigma(\rho)/T_c$, reduced temperature at coexistence for the equation of state
$\Theta(\rho)$	defined locus of temperatures
$u(T)$	defined in various equations
v	$1/\rho$, molar volume, m^3/kg
$W(\rho,T)$	the velocity of sound, m/s
$x(T)$	$(T_c - T)/(T_c - T_t)$
$x_o(T)$	T/100
Z	compressibility factor

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(1) The gas constant is increased slightly in value from earlier work in view of the recent report of Rowlinson and Tildesley [60].

APPENDIX B. Conversion of Units

In the following table the molecular weight of normal butane is given by mol. wt. ≡ 58.1243 g/mol. Also, 1 cal_{th} = 1 cal (thermochemical) = 4.184 J and 1 BTU_{IT} = 1 BTU (International Table) = 1055.056 J.

To convert from	To	Multiply by
Pressure, MPa	bar	10.
	atm	9.86923
	kg/cm^2	10.1972
	lb/in^2	145.038
Volume, m^3	liter (L)	1000.
	ft^3	35.3147
Density, kg/m^3	g/cm^3	0.001
	mol/L	1./(mol. wt.)
	lb/ft^3	0.062428
Molar energy, J/mol	$MPa \cdot m^3/kg$	0.001/(mol. wt.)
	bar•L/mol	0.01
	cal_{th}/mol	0.239006
	BTU_{IT}/lb	0.429923/(mol. wt.)
Molar entropy, J/(mol•K)	$BTU_{IT}/(lb \cdot {}^{o}F)$	0.238846/(mol. wt.)

APPENDIX C. Fixed-Point Values for Normal Butane

Critical Point

P_c = 3.7960 MPa

ρ_c = 227.85 kg/m^3 (3.92 mol/L)

T_c = 425.16 K

Normal Boiling Point

P = 0.101325 MPa

T = 272.638 K

ρ_v = 2.709 kg/m^3 (0.04661 mol/L)

ρ_ℓ = 601.09 kg/m^3 (10.341 mol/L)

Triple Point

P_t = 6.7358×10^{-7} MPa

T_t = 134.86 K

ρ_v = 3.4916×10^{-5} kg/m^3 (6.0071×10^{-7} mol/L)

ρ_ℓ = 735.27 kg/m^3 (12.650 mol/L)

APPENDIX D. Normal Butane Properties Reference Index

Melting Line	Date	Pressure Range, MPa
Reeves [59]	1964	200 - 1000

Vapor Pressures	Date	Temperature Range, K
Seibert [66]	1915	303 - 403
Dana [19]	1926	255 - 331
Delaplace [22]	1937	135 - 151
Sage [64]	1937	294 - 394
Beattie [2]	1939	348 - 423
Aston [1]	1940	195 - 273
Kay [44]	1940	325 - T_c
Wackher [74]	1945	205 - 279
Tickner [71]	1951	136 - 196
Connolly [15]	1962	344 - T_c
Hirata [39]	1966	333 - 401
Carruth [11]	1973	135 - 213
Thermal loops (This report)	1982	T_t - 270

Saturated Liquid Densities	Date	Temperature Range, K
Dana [19]	1926	273 - 329
Coffin [13]	1928	239 - 306
Van der Vet [73]	1937	283 - 323
Sage [64]	1937	294 - 394
Kay [44]	1940	325 - T_c
Benoliel [6]	1941	213 - 293
Carney [10]	1942	228 - 333
NGAA [69]	1942	227 - 333
Olds [51]	1944	311 - 411
Foehr [24]	1949	293
Connolly [14]	1956	293 - 298
Sliwinski [67]	1969	283 - 368
Kahre [42]	1973	289 - 328
McClune [49]	1976	143 - 173
Haynes [36,37]	1976	135 - 300
Orrit [53]	1978	135 - 275

APPENDIX D. (Continued)

Saturated Vapor Densities	Date	Temperature Range, K
Dana [19]	1926	281 - 321
Sage [64]	1937	294 - 394
Kay [44]	1940	325 - T_c
Olds [51]	1944	311 - 411
Sliwinski [67]	1969	283 - 368
Virial/vapor pressure equations (This report)	1982	135 - 270

Virial Coefficients	Date	Temperature Range, K
Sage [64]	1937	311 - 394
Beattie [3]	1939	423 - 573
Kay [44]	1940	311 - 589
Beattie [4]	1942	423 - 573
Olds [51]	1944	311 - 511
Kretshmer [45]	1951	303
Gunn [33]	1958	344 - 511
Connolly [15]	1962	344 - 444
McGlashan [50]	1962	296 - 413
Tripp [72]	1962	283 - 323
Kapallo [43]	1963	244 - 321
Bottomley [8]	1964	273 - 426
Jones [41]	1967	368 - 498
Strein [68]	1971	296 - 498
Bottomley [7]	1977	316 - 580

Compressibility Data	Date	Range of T, K	Range of P, MPa
Sage [64]	1937	294 - 394	0.1 - 20.7
Beattie [3]	1939	423 - 573	1.5 - 36.3
Kay [44]	1940	311 - 589	0.2 - 8.3
Olds [51]	1944	311 - 511	0.07 - 68.9
Haynes [35]	1981	140 - 300	1.7 - 36.1
Virial equation (This report)	1982	300 - 700	0.2 - 0.6

APPENDIX D. (Continued)

Specific Heats	Date	Type	Range of T, K
Dana [19]	1926	$C_\sigma(T)$	257 - 294
Huffman [40]	1931	$C_\sigma(T)$	140 - 262
Sage [65]	1937	$C_p(T)$	294 - 411
Aston [1]	1940	$C_\sigma(T)$	140 - 268
Dailey [18]	1943	$C_p^o(T)$	345 - 693
Chen [12]	1975	$C_p^o(T)$	Spectroscopic

Heats of Vaporization	Date	Temperature Range, K
Dana [19]	1926	275 - 297
Sage [64]	1937	294 - 394
Das [20]	1967	273 - 420
Das [21]	1973	280 - 420
Thermal loops (This report)	1982	T_t - 270
Clapeyron equation (This report)	1982	140 - 420

Sound Velocities	Date	Temperature Range, K
Rao [58]	1971	143 - 268

Dielectric Constants	Date	Temperature Range, K
Sliwinski [67] (index of refraction)	1969	283 - 368
Thompson [70]	1980	228
Luo [47]	1981	220 - 289
Haynes [35,38]	1981	135 - 303

APPENDIX E. Computer Program

```
      PROGRAM NBTHRMB (INPUT,OUTPUT)
C    REVISION OF NBUTANE THERMOFUNCTIONS, RDG/NBS, START MAR. 26, 1981.
      COMMON GK,GKK, B1,B2,B3,B4,B5, C1,C2,C3, E1,E2,E3, ER, IX
      COMMON/1/AL,BE,GA,DE,EP,ET, DCRT,TCRT,PCRT, DGAT,DTRP,TTRP,PTRP
      COMMON/3/DPDT,D2PDT2,DPSDT,DPMDT,DPDD,DPDR,DTSDR,DTHDR,DDSDT
      COMMON/4/XB1,XB2, XC1,XC2, XE1,XE2, DXBDR,DXCDR,DXEDR
      COMMON/6/ TSAT, THETA, PSAT
      COMMON/8/ IN,IK, P,T,DEN, E,H,S, CV,CP,CSAT, W,WK
      COMMON/9/ DNG,EG,HG,SG, CVG,CPG,WG, DPGDT,DPGDD
      COMMON/11/ DELS, DELCV
      COMMON/12/ZCRT,ZCALC,DZDT, ZSAT,DZSDT, ZFX, FRT,DFRTDT
      COMMON/21/ TPS(70)
      COMMON/95/ PIS, DIS, DPTIS, DPDIS
      COMMON/99/ TI,EZZ, EZ,SZ,CVZ, HZ,CPZ
      DIMENSION HZA(70), SZA(70), PP(99)
      DATA (WM=58.1243),(PA=1.01325),(GJ=8.3145)
    1 FORMAT(I5, 2F10.0)
    2 FORMAT(I5, 3F10.0)
    3 FORMAT(8I10)
    5 FORMAT(1X)
    9 FORMAT(8F10.0)
   14 FORMAT(1H1 13X *  NBUTANE ISOBAR AT P =* F10.6, 4H MPA / )
   16 FORMAT( 9X1HT 8X3HDEN 9X3HDEN 8X1HZ 5X5HDP/DT 5X5HDP/DD
     2 8X1HE 8X1HH 8X1HS 6X2HCV 6X2HCP 9X3HF/P 5X1HW 4X5HDIEL. /
     3  9X1HK 6X5HMOL/L 7X5HKG/M3 9X 5X5HMPA/K 1X9HMPA-M3/KG
     4 4X5HJ/MOL 4X5HJ/MOL 2X7HJ/MOL/K 1X7HJ/MOL/K 1X7HJ/MOL/K
     5 12X 1X5HM/SEC 4X5HCONST )
   17 FORMAT(1X F9.3, E11.4, E12.5, F9.5, F10.6, F10.5,
     1 2F9.1, F9.3, 2F8.2, E12.5, I6, F9.5)
   20 FORMAT(1H116X*TEST IDEAL FNCTNS*/17X 3HT,K 7X3HHZA 7X3HSZA )
   21 FORMAT(10X F10.2, F10.1, F10.3)
   80 CALL PVTDATA
      CALL PEEK   $   CALL ISOTHRM
C    COMPUTE THERMOFUNCTIONS ON ISOBARS. START ON THE MELTING LINE.
C    NOTE, ISOBAR P=PCRT OK, BUT ISOTHERM T=TCRT IS EXCLUDED.
C    ISOBARS AT P UNDER PCRT TRAVERSE THE DOME.
C    NOTE USE OF QVAP ,DATA, TO CROSS THE ,DOME,.
C    NOTE USE OF CSAT ,DATA, FOR SPECIFIC HEATS IN COMPRESSED LIQUID.
C    NOTE TPS(IK) USED BY COMPRES.
C    GET FUGACITIES, F/P, VIA H,S, HZ(T),SZ(T).  (J.F.ELY).
C    SAVE HZA(70), SZA(70) FROM  90 THRU 700 K.
   85 DO 86 J=9,70  $  TI = 10*J  $  CALL IDEAL  $  HZA(J) = HZ
   86 SZA(J) = SZ
C  87 PRINT 20  $  DO 88 J=9,70  $  T = 10*J
C  88 PRINT 21, T, HZA(J), SZA(J)
   89 CALL JTLOCUS  $  CALL TABLIQ
   90 IN = 1  $  NI = 57  $  READ 9, (PP(I),I=1,NI)
   91 DO 300 I=IN,NI  $  IK = I  $  LS = 0
   92 P = PP(I)  $  IF(I.EQ.26)  P = PCRT
   93 PK = P/10  $  PRINT 14, PK  $  PRINT 16
  100 T = FINDTMF(P)  $  CALL COMPRLQ  $  V=1/DEN  $  IW=W
  101 Z = P/DEN/GKK/T  $  DIE = DIELF(DEN,T,P)
  102 TI = T  $  CALL IDEAL  $  GIB = H-EZZ-HZ - T*(S-SZ)
  103 XP = EXP(GIB/GJ/T)  $  FOP = XP*PA/P  $  CALL CON
```

```
  104 PRINT 17, T,DEN,DIS,Z, DPTIS,DPDIS, E,H,S,CV,CP, FOP,IW,DIE
  105 IT = T/10  $  IF(P.LT.PCRT) 110,180
C    CASES FOR P LESS THAN PCRT.
  110 TPS(IK) = TS = FINDTSF(P)   $   K = L = 0
  111 DO 150 J=1,99  $  T = JT = 10*(IT+J)
  112 IF(T.LT.TS) 113,117
  113 CALL COMPRES  $  V = 1/DEN  $  IW = W
  114 Z = P/DEN/GKK/T  $  DIE = DIELF(DEN,T,P)
      M =JT/10  $  GIB = H-EZZ-HZA(M) - T*(S-SZA(M))
      XP = EXP(GIB/GJ/T)  $  FOP = XP*PA/P  $  CALL CON
  115 PRINT 17, T,DEN,DIS,Z, DPTIS,DPDIS, E,H,S,CV,CP, FOP,IW,DIE
  116 GO TO 150
  117 LS = LS + 1  $  IF(LS.EQ.1) 120,130
C    CASE FOR SATURATED LIQUID AND VAPOR.
  120 T = TS  $  CALL COEXIST $ V=1/DEN $ VG=1/DNG $ IW=W $ IWG=WG
  121 Z = P/DEN/GKK/T  $  ZG = P/DNG/GKK/T
  122 DIEL = DIELF(DEN,T,P)  $  DIEG = DIELF(DNG,T,P)
  123 TI = T  $  CALL IDEAL  $  GIB = H-EZZ-HZ - T*(S-SZ)
  124 FOP = EXP(GIB/GJ/T)*PA/P  $  CALL CON
  125 PRINT 17, T,DEN,DIS,Z, DPTIS,DPDIS, E,H,S,CV,CP, FOP,IW,DIEL
  126 PRINT 5 $ DIS=DNG*WM $ DPTIS=DPGDT/10 $ DPDIS = DPGDD/10/WM
  127 PRINT 17, T,DNG,DIS,ZG,DPTIS,DPDIS,EG,HG,SG,CVG,CPG,FOP,IWG,DIEG
  128 T = JT
C    CASES FOR THE HOMOGENEOUS DOMAIN.
  130 IF(JT.GT.500) 131,132
  131 K = K+1  $  T = JT = JT + 10*K  $  IF(JT.GT.700) 300,132
  132 CALL GENIUS   $  V=1/DEN $ IW=W  $  Z = P/DEN/GKK/T
  133 IF(T.GT.450) 134,135
  134 DIE = 0  $  GO TO 136
  135 DIE = DIELF(DEN,T,P)
  136 M =JT/10  $  GIB = H-EZZ-HZA(M) - T*(S-SZA(M))
  137 XP = EXP(GIB/GJ/T)  $  FOP = XP*PA/P  $  CALL CON
  141 PRINT 17, T,DEN,DIS,Z, DPTIS,DPDIS, E,H,S,CV,CP, FOP,IW,DIE
  150 CONTINUE
C    FOR P.GE.PCRT, CASES FOR T.LT.OR.T.GT.TCRT.
  180 TPS(IK) = TCRT  $  K = L = 0
  181 DO 250 J=1,99  $  T = JT = 10*(IT+J)
  182 IF(T.LT.TCRT) 190,210
C    CASE A FOR T LESS THAN TCRT.
  190 CALL COMPRES  $  V = 1/DEN  $  IW = W
  191 Z = P/DEN/GKK/T  $  DIE = DIELF(DEN,T,P)
  192 M =JT/10  $  GIB = H-EZZ-HZA(M) - T*(S-SZA(M))
  193 XP = EXP(GIB/GJ/T)  $  FOP = XP*PA/P  $  CALL CON
  194 PRINT 17, T,DEN,DIS,Z, DPTIS,DPDIS, E,H,S,CV,CP, FOP,IW,DIE
  195 GO TO 250
C    CASE FOR T ABOVE TCRT, HOMOGENEOUS DOMAIN.
  210 IF(JT.GT.500) 211,220
  211 K = K+1  $  T = JT = JT + 10*K  $  IF(JT.GT.700) 300,220
  220 CALL GENIUS  $  V=1/DEN $ IW=W $ Z = P/DEN/GKK/T
  221 IF(T.GT.450) 222,223
  222 DIE = 0  $  GO TO 224
  223 DIE = DIELF(DEN,T,P)
  224 M =JT/10  $  GIB = H-EZZ-HZA(M) - T*(S-SZA(M))
  225 XP = EXP(GIB/GJ/T)  $  FOP = XP*PA/P  $  CALL CON
```

```
  226 PRINT 17, T,DEN,DIS,Z, DPTIS,DPDIS, E,H,S,CV,CP, FOP,IW,DIE
  250 CONTINUE
  300 CONTINUE
  999 STOP   $   END

      SUBROUTINE COEXIST
C    GIVEN T AT COEXISTENCE, GET BOTH VAPOR AND LIQUID FUNCTIONS.
C    FOR VAPOR, GET  DNG,EG,HG,SG, CVG,CPG,WG, DPGDT,DPGDD,  -
C    FOR LIQUID, GET  DEN,E,H,S, CV,CP,CSAT,W. DPDT,DPDD.
C    COEXIST CALLED BY COMPRLQ. P NOT USED, MUST NOT CHANGE.
      COMMON/1/AL,BE,GA,DE,EP,ET, DCRT,TCRT,PCRT, DGAT,DTRP,TTRP,PTRP
      COMMON/3/DPDT,D2PDT2,DPSDT,DPMDT,DPDD,DPDR,DTSDR,DTHDR,DDSDT
      COMMON/8/ IN,IK, P,T,DEN, E,H,S, CV,CP,CSAT, W,WK
      COMMON/9/DNG,EG,HG,SG, CVG,CPG,WG, DPGDT,DPGDD
      COMMON/11/ DELS, DELCV
      COMMON/99/ TI,EZZ, EZ,SZ,CVZ, HZ,CPZ
      DATA (Q=1.01325),(G=0.083145)
    1 FORMAT(1H0 9X *T EXCEEDS TCRT IN COEXIST. * / )
    2 IF(T.GT.TCRT) 3,4
    3 PRINT 1   $   STOP
    4 PS = PSATF(T)  $  DNG = DB = DENGASF(T)
    5 TI = T  $  CALL IDEAL  $  M = 15  $  DA = L = 0
    6 EG = EZZ + EZ + EDELF(L,M,T,DA,DB)  $  HG = EG + 100*PS/DB
    7 SG = SZ + DELS - 100*G*ALOG(G*T*DB/Q)
    8 IF(T.EQ.TCRT) 9,11
    9 PX = PVTF(T,DB,1)  $  DPGDT = DPDT  $  DPGDD = DPDD
   10 CPG = CVG = WG = 0  $  GO TO 15
   11 CVG = CVZ + DELCV  $  PX = PVTF(T,DB,1)
   12 CPG = CVG + 100*T/DPDD*(DPDT/DB)**2  $  WG = SQRT(WK*CPG*DPDD/CVG)
   13 DPGDT = DPDT  $  DPGDD = DPDD
C    NOW TRAVERSE THE ,DOME, USING QVAP ,DATA,.
   15 DEN = DL = DENLIQF(T)  $  DDLDT = DDSDT  $  QV = QVAPXF(T)
   16 H = HG - QV  $  S = SG - QV/T   $   E = H - 100*PS/DL
C    THIS RETURN AT 16+ USED ONLY  WHEN CALLING SSATFIT, HSATFIT.
   17 IF(T.EQ.TCRT) 18,19
   18 PX = PVTF(T,DL,1)  $  CP=CV=CSAT=W=0  $  RETURN
   19 CSAT = CSATXF(T)  $  PX = PVTF(T,DL,1)
   22 CV = CSAT + 100*T*DPDT*DDLDT/DL/DL
   23 CP = CV + 100*T/DPDD*(DPDT/DL)**2
   30 W = SQRT(WK*CP*DPDD/CV)   $   RETURN  $  END

      SUBROUTINE COMPRES
C    SAVES COMPUTER TIME INTEGRATING COMPRLIQ AT T.LT.TCRT.
C    FOR T = INTEGER MULTIPLES OF 10 K. FIRST ISOBAR USES COMPRLQ.
C    FOR SUCCEEDING ISOBARS, START ON PREVIOUS ISOBAR, EXCEPT -
C    AT TEMPS GE TPS(IK-1) ON PREVIOUS ISOBAR, MUST USE COMPRLQ.
      COMMON/1/AL,BE,GA,DE,EP,ET, DCRT,TCRT,PCRT, DGAT,DTRP,TTRP,PTRP
      COMMON/3/DPDT,D2PDT2,DPSDT,DPMDT,DPDD,DPDR,DTSDR,DTHDR,DDSDT
      COMMON/8/ IN,IK, P,T,DEN, E,H,S, CV,CP,CSAT, W,WK
      COMMON/11/ DELS, DELCV
      COMMON/21/ TPS(70)
      DIMENSION DK(50),EK(50),SK(50),CK(50)
    1 FORMAT(1H0 9X *T G.E. TCRT IN COMPRES. * / )
    2 IF(T.GE.TCRT) 3,4
```

```
    3 PRINT 1   $   STOP
    4 J = T/10  $  IF(T - 10*J) 5,6
    5 CALL COMPRLQ   $   RETURN
    6 IF(IK.EQ.IN) 7,9
    7 CALL COMPRLQ
    8 DK(J)=DEN $ EK(J)=E $ SK(J)=S $ CK(J)=CV  $  RETURN
C    INTEGRATE FROM OLD DEN TO NEW DEN ON GIVEN ISOTHERM -
C    EXCEPT IF T EXCEEDS OLD TMAX, USE COMPRLQ.
    9 IF(T.GE.TPS(IK-1))  GO TO 7
   10 DA=DK(J) $ DK(J) = DEN = DB = FINDENF(T,P)  $  N = 13
   11 EK(J) = E = EK(J) + EDELF(1,N,T,DA,DB)  $  H = E + 100*P/DB
   12 SK(J) = S = SK(J) + DELS  $  CK(J) = CV = CK(J) + DELCV
C    GET NEW DP/DT, DP/DD, CP, W.
   15 PX = PVTF(T,DB,1)  $  CP = CV + 100*T/DPDD*(DPDT/DB)**2
   30 W = SQRT(WK*CP*DPDD/CV)   $   RETURN  $  END

      SUBROUTINE COMPRLQ
C    GIVEN P,T FOR COMPR.LIQ. AT T.LT.TC, GET DEN AND FUNCTIONS.
C    REVISED TO USE HSATF, SSATF, CSATXF, BUT NOT COEXIST. TIMESAVER.
C    INTEGRATE ALONG ISOTHERM T FROM SATLIQ UP TO POINT (P,T).
      COMMON/1/AL,BE,GA,DE,EP,ET, DCRT,TCRT,PCRT, DGAT,DTRP,TTRP,PTRP
      COMMON/3/DPDT,D2PDT2,DPSDT,DPMDT,DPDD,DPDR,DTSDR,DTHDR,DDSDT
      COMMON/8/ IN,IK, P,T,DEN, E,H,S, CV,CP,CSAT, W,WK
      COMMON/11/ DELS, DELCV
    1 FORMAT(1H0 9X *T NOT UNDER TCRT IN COMPRLQ.*/)
    2 IF(T.GE.TCRT) 3,4
    3 PRINT 1   $   STOP
C    GET PSAT, DENLIQ, AND SATLIQ FUNCTIONS FOR START.
    4 PS = PSATF(T)  $  DL = DENLIQF(T)  $  DDLDT = DDSDT
    6 HS = HSATF(T)  $  ES = HS - 100*PS/DL  $  SS = SSATF(T)
C   7 IF(T.GT.340) 8,9
C   8 CVS = CVSATF(T)  $  GO TO 10
    9 PX=PVTF(T,DL,0)  $  CVS = CSATXF(T) + 100*T*DPDT*DDLDT/DL/DL
C    INTEGRATE UP TO POINT (P,T).
   10 DB = FINDENF(T,P)  $  DX = DB - DL  $  IF(DX.GT.0) 11,20
   11 M = 14  $  E = ES + EDELF(1,M,T,DL,DB)
   12 H = E + 100*P/DB  $  S = SS + DELS  $  CV = CVS + DELCV
   13 PX = PVTF(T,DB,1)  $  CP = CV + 100*T/DPDD*(DPDT/DB)**2
   14 W = SQRT(WK*CP*DPDD/CV)  $  DEN = DB   $   RETURN
   20 DEN=DL $ E=ES $ H=HS $ S=SS $ CV=CVS  $  PX = PVTF(T,DL,1)
   21 CP = CV + 100*T/DPDD*(DPDT/DL)**2  $  W = SQRT(WK*CP*DPDD/CV)
   30 RETURN   $   END

      SUBROUTINE CON
C    CONVERT TO SI UNITS FOR P, DEN, DP/DT, DP/DD,
      COMMON/3/DPDT,D2PDT2, DPSDT,DPMDT,DPDD,DPDR,DTSDR,DTHDR,DDSDT
      COMMON/8/IN,IK, P,T,DEN, E,H,S, CV,CP,CSAT, W,WK
      COMMON/95/ PIS, DIS, DPTIS, DPDIS
      DATA (WM = 58.1243)
    1 PIS = P/10  $  DIS = DEN*WM
    2 DPTIS = DPDT/10  $  DPDIS = DPDD/10/WM
    9 RETURN   $   END

      FUNCTION CSATXF(T)
```

```
C     NBUTANE SATLIQ CSAT, J/MOL/K.
C    CONSTRAINED AT TRIPLE AND CRITICAL POINTS.
C    Y # (S-SCRT)/(STRP-SCRT),  X # (TC-T)/(TC-TT).
C    Y = X + (XE-X)*(A1 + A2*X + A3*X2 + . . . ).
      DIMENSION AS(6)
      DATA (NFS=6),(ES=0.23),(TTRP=134.86),(TCRT=425.16)
      DATA (STRP = 133.54372),(SCRT = 297.64652)
      DATA (AS = 0.08883444348, -0.3470304947, 0.2093724392,
     1 -0.9568328496, 0.9579992545, -0.6534607056)
    1 FORMAT(1H0 9X *CSATXF, T.GT.TCRT. * / )
    2 IF(TCRT-T) 3,4,5
    3 PRINT 1   $   STOP
    4 CSATXF = 0   $   RETURN
    5 XN=TCRT-TTRP $ X = (TCRT-T)/XN $ DXDT = -1/XN $ SN=STRP-SCRT
    6 XE = X**ES  $  V = XE -X  $  V1 = ES*XE/X - 1
    7 Z1 = Z = 0  $  DO 9 K=1,NFS  $  L = K - 1  $  XL = X**L
    8 Z = Z + AS(K)*XL  $  Z1 = Z1 + L*AS(K)*XL/X
    9 CONTINUE  $  DSDT = SN*(1 + V*Z1 + V1*Z)*DXDT
   10 CSATXF = T*DSDT  $  RETURN  $  END

      FUNCTION DELTAF(T,D)
C    GET (T*DP/DT - D*DP/DD) FOR THE J-T INVERSION CURVE.
      COMMON/1/AL,BE,GA,DE,EP,ET, DCRT,TCRT,PCRT, DGAT,DTRP,TTRP,PTRP
      COMMON/3/DPDT,D2PDT2,DPSDT,DPMDT,DPDD,DPDR,DTSDR,DTHDR,DDSDT
    1 IF(T-TCRT) 2,4,4
    2 DL = DENLIQF(T)  $  IF(D-DL) 3,3,4
    3 DELTAF = 1.0E+100  $  RETURN
    4 P = PVTF(T,D,1)
    5 DELTAF = ABS (T*DPDT-D*DPDD)   $   RETURN  $  END

      FUNCTION DENGASF(T)
C    DESIGNED FOR ZSAT = 1 AT LOW DENSITIES, 5/29/77.
C    USE ZSAT # PS/DS/GK/TS WITH VAPOR PRESSURES, AND ZCRT.
C    Z = 1 + (ZCRT-1)*PI*F(X)/X/X.
C    F(X) # 1 + A1*UE + A2*U + A3*EXP(EGX*(1-1/U)).
C    NOTE ZSM1 FOR FUGACTY, NOT IN COMMON HERE.
      COMMON/1/AL,BE,GA,DE,EP,ET, DCRT,TCRT,PCRT, DGAT,DTRP,TTRP,PTRP
      COMMON/3/DPDT,D2PDT2,DPSDT,DPMDT,DPDD,DPDR,DTSDR,DTHDR,DDSDT
      COMMON/12/ZCRT,ZCALC,DZDT, ZSAT,DZSDT, ZFX, FRT,DFRTDT
      DIMENSION AV(3)
      DATA (EG=0.35),(EGX=2.30),(GKK=0.083145)
      DATA(AV = -0.8665772894, 1.120397967, 4.498658942)
    1 FORMAT(1H0 9X *T EXCEEDS TC IN DENGASF. * / )
    2 IF(TCRT-T) 3,4,5
    3 PRINT 1   $   STOP
    4 DENGASF = DCRT  $  DDSDT = 1.0E+10  $  RETURN
    5 ZN = ZCRT-1  $  PC = PCRT  $  P = PSATF(T)
    6 PI = P/PC  $  PIT = DPSDT/PC  $  TC = TCRT  $  X = T/TC
    7 X2 = X*X  $  U = 1-X
    8 UE = U**EG  $  UE1 = -EG*UE/U
    9 EGXU = EGX*(1-1/U)  $  IF(EGXU.LT.-270) 10,11
   10 XP = XP1 = 0  $  GO TO 12
   11 XP = EXP(EGXU)  $  XP1 = -EGX*XP/U/U
   12 F = 1 + AV(1)*UE + AV(2)*U + AV(3)*XP  $  ZFX = F
```

```
   13 F1 = AV(1)*UE1 - AV(2) + AV(3)*XP1
   15 ZSM1 = ZN*PI*F/X2  $  ZSAT = Z = 1 + ZSM1  $  ZCALC = Z
   16 DZSDT = DZDT = (PI*(F1-2*F/X)/TC + F*PIT)*ZN/X2
   17 DENGASF = P/T/Z/GKK
   18 DDSDT = (DPSDT - P/T - P*DZDT/Z)/T/Z/GKK  $  RETURN  $  END

      FUNCTION DENLIQF(T)
C    NBUTANE SAT.LIQUID DEN, MOL/L, (DCRT=3.92), RDG, MAR. 19, 1981.
C    DEN = DCRT + YNL*(X + (XE-X)*Y),   YNL # DTRP - DCRT.
C    Y # A1 + A2*X + A3*X2 + A4*X3.
      COMMON/3/DPDT,D2PDT2,DPSDT,DPMDT,DPDD,DPDR,DTSDR,DTHDR,DDSDT
      DIMENSION AW(3)
      DATA (EL=0.35),(NFL=3)
      DATA (TTRP=134.86),(TCRT=425.16),(DCRT=3.92),(DTRP=12.65)
      DATA(AW = 0.794388335, -0.001089476, -0.085829197)
    1 FORMAT(1HO 9X *DENLIQF = 0, T EXCEEDS TCRT. * / )
    2 IF(TCRT-T) 3,4,5
    3 PRINT 1   $   STOP
    4 DENLIQF = DCRT  $  DDSDT = -1.0E+10  $  RETURN
    5 XN=TCRT-TTRP $ X=(TCRT-T)/XN $ X2 = X*X  $  DXDT = -1.0/XN
    6 XE = X**EL  $  U = XE - X  $  U1 = EL*XE/X - 1
    7 Y1 = Y = 0  $  DO 9 K=1,NFL  $  L = K-1  $  XL = X**L
    8 Y = Y + AW(K)*XL  $  Y1 = Y1 + AW(K)*L*XL/X
    9 CONTINUE   $   YNL = DTRP - DCRT
   11 DENLIQF = DCRT + YNL*(X + U*Y)
   12 DDSDT = YNL*(1 + U*Y1 + U1*Y)*DXDT   $   RETURN  $  END

      FUNCTION DIELF(D,T,P)
C    NBUTANE CONSTS., RDG, OCT. 14, 1980, VIA HAYNES DATA.
C    CM,RMSPCT = 0.083,  E,RMSPCT = 0.017.
C    CM = A1 + A2*R + A3*R2 + A4/X + A5*PI.
      DIMENSION A(5)
      DATA (DCRT=3.92),(TCRT=425.16)
      DATA(A = 20.654382, 0.25129317, -0.097230479,
     1 -0.039216489, -0.011645515)
    1 R = D/DCRT  $  X = T/TCRT  $  G = 1/X  $  PI = P/100
    2 CM = A(1) + A(2)*R + A(3)*R*R + A(4)*G + A(5)*PI
    3 Z = CM*D/1000  $  DIELF = (2*Z+1)/(1.0-Z)
    5 RETURN   $   END

      FUNCTION EDELF(L,M,T,DA,DB)
C    GET CHANGE OF E, S, CV WITH DENSITY ALONG ISOTHERMS.
C    GET EDELF, DELS, DELCV FROM DA TO DB ON ISOTHERM T.
C    ROMBERG NUMERICAL INTEGRATION VIA  -
C    CARNAHAN/LUTHER/WILKES, APPLIED NUMERICAL METHODS, P. 90,
C    JOHN WILEY AND SONS, INC., N.Y., 1969.
C    NOTE, VALUE OF LD CONTROLS CONVERGENCE LIMITS.
C    NOTE, NMAX = M, NK = FINAL, TOTAL SUBDIVISIONS OF INTERVAL DX.
      COMMON/1/AL,BE,GA,DE,EP,ET, DCRT,TCRT,PCRT, DGAT,DTRP,TTRP,PTRP
      COMMON/3/DPDT,D2PDT2,DPSDT,DPMDT,DPDD,DPDR,DTSDR,DTHDR,DDSDT
      COMMON/11/ DELS, DELCV
      COMMON/12/ZCRT,ZCALC,DZDT, ZSAT,DZSDT, ZFX, FRT,DFRTDT
      DIMENSION E(20), S(20), C(20)
      DATA (LD=2),(DI=0.00001),(G=0.083145)
```

```
    1 FORMAT(1H09X*EDELF L =*I2,5H, N =I3,5H, T = F8.3,6H, DA =E10.4,
     1 6H, DB =E10.4, 6H, LD =I2//
     2 10X 1HN 7X5HEDELF 8X4HDELS 7X5HDELCV )
    2 FORMAT(1H0 9X 6HEDIF =F10.3, 8H, SDIF =F10.5, 9H, CVDIF =F10.3)
    3 FORMAT(6X I5, F12.3, F12.5, F12.3)
    4 FORMAT(1H0 9X *EDELF NG AT TCRT FOR CV AT DEN NEAR OR GT C.P.*/)
C    FOR DA=0 AND DB.LE.DI, IDEAL GAS, EDELF=DELS=DELCV=0.
C    FOR DA=0 AND DB.GT.DI, START ROMBERG WITH DA = DI,  -
C    TO AVOID INFINITIES IN ORDINATE FUNCTIONS AT DA = 0.
    5 NK = 1  $  DM = DCRT/2  $  DZ = 0.98*DCRT
    9 ZK = 1.0 - 1/ZCRT  $  RK = 100*G*TCRT/DCRT
   10 IF(L.EQ.0) 11,14
   11 IF(DB.LE.DI) 12,13
   12 EDELF = DELS = DELCV = 0   $   RETURN
   13 DA = DI
C    GET FIRST TRAPEZOID AREA, E(1) ETC., FROM DA TO DB.
   14 DX = DB - DA  $  P = PVTF(T,DA,0)  $  IF(DA.LT.DM) 16,17
   16 EA = RK*(ZK*ZSAT*ZFX + FRT - T*DFRTDT)  $  GO TO 18
   17 EA = 100*(P-T*DPDT)/DA/DA
   18 IF(L.EQ.0) 19,20
   19 SA = -RK*DFRTDT  $  GO TO 21
   20 SA = -100*DPDT/DA/DA
   21 CA = -100*T*D2PDT2/DA/DA
   22 P = PVTF(T,DB,0)  $  IF(DB.LT.DM) 23,24
   23 EB = RK*(ZK*ZSAT*ZFX + FRT - T*DFRTDT)  $  GO TO 25
   24 EB = 100*(P-T*DPDT)/DB/DB
   25 IF(L.EQ.0) 26,27
   26 SB = -RK*DFRTDT  $  GO TO 28
   27 SB = -100*DPDT/DB/DB
   28 CB = -100*T*D2PDT2/DB/DB
   29 E(1)=(EA+EB)*DX/2  $  S(1)=(SA+SB)*DX/2  $  C(1)=(CA+CB)*DX/2
C    INTERVAL HALVING, GET E(N+1), ETC.
   30 DO 60 N=1,M   $   K = N + 1
   31 JM = 2**N - 1  $  DXN = DX/2**N  $  E(K) = S(K) = C(K) = 0
   33 DO 45 J=1,JM,2  $  NK = NK+1  $  DN = DA + J*DXN
   34 P = PVTF(T,DN,0)  $  IF(DN.LT.DM) 35,36
   35 EB = RK*(ZK*ZSAT*ZFX + FRT - T*DFRTDT)  $  GO TO 37
   36 EB = 100*(P-T*DPDT)/DN/DN
   37 IF(L.EQ.0) 38,39
   38 SB = -RK*DFRTDT  $  GO TO 40
   39 SB = -100*DPDT/DN/DN
   40 CB = -100*T*D2PDT2/DN/DN
   41 E(K) = E(K) + EB  $  S(K) = S(K) + SB  $  C(K) = C(K) + CB
   45 CONTINUE   $   E(K) = E(N)/2 + E(K)*DXN
   46 S(K) = S(N)/2 + S(K)*DXN   $   C(K) = C(N)/2 + C(K)*DXN
C
C    TEST FOR CONVERGENCE.
   50 ED=ABS(E(K)-E(N))  $  SD=ABS(S(K)-S(N))  $  CD=ABS(C(K)-C(N))
   53 IF(ED.LT.0.4/LD) 54,60
   54 IF(SD.LT.0.002/LD) 55,60
   55 IF(T.EQ.TCRT.AND.DB.GT.DZ)  GO TO 57
   56 IF(CD.LT.0.04/LD) 57,60
   57 EDELF = E(K)  $  DELS = S(K)  $  DELCV = C(K)  $  RETURN
   60 CONTINUE  $  N = M  $  NM = N-1  $  NP = N+1
```

```
   61 PRINT 1, L, N, T, DA, DB, LD
   62 PRINT 3, NM,E(NM),S(NM),C(NM)  $  PRINT 3, N,E(N),S(N),C(N)
   64 PRINT 3, NP,E(NP),S(NP),C(NP)   $   PRINT 2, ED, SD, CD
   99 STOP   $   END

      FUNCTION FINDENF(T,P)
C    ON ISOTHERM T, FIND DEN, MOL/L, TO MINIMIZE (P-PC) VIA EQNSTATE.
      COMMON/1/AL,BE,GA,DE,EP,ET, DCRT,TCRT,PCRT, DGAT,DTRP,TTRP,PTRP
      COMMON/3/DPDT,D2PDT2,DPSDT,DPMDT,DPDD,DPDR,DTSDR,DTHDR,DDSDT
      DATA (GKK = 0.083145)
   41 FORMAT(1HO 9X *FINDENF = 0,  FAILS TO CONVERGE. * / )
   42 FORMAT(1HO 9X *FINDENF = DCRT, DP/DR ZERO OR NEG. * / )
   43 FORMAT(1HO 9X *FINDENF = 0, DOUBLE-VALUED AT P = PSAT. * / )
      DM = 1.05*DTRP
      IF(P.GT.0) 1,35
    1 IF(T-TCRT) 2,5,8
    2 DG=DENGASF(T) $ DL=DENLIQF(T) $ PS=PSATF(T)  $  IF(P-PS) 3,32,4
    3 D = DG/2  $  GO TO 11
    4 D = (DL+DTRP)/2  $  GO TO 11
    5 DG=DL=DCRT  $  PS=PCRT  $  IF(P-PS) 6,33,7
    6 D = DCRT/2  $  GO TO 11
    7 D = 2*DCRT  $  GO TO 11
    8 IF(T.LT.450.0) 9,10
    9 PC = PVTF(T,DCRT,0)  $  IF(P-PC) 6,33,7
   10 D = DCRT
   11 DO 30 J=1,50 $ DP=P-PVTF(T,D,1) $ IF(ABS (DP/P)-1.0E-7) 31,31,12
   12 IF(DPDD.GT.0) 13,34
   13 DD = DP/DPDD  $  IF(ABS (DD/D)-1.0E-7) 31,31,14
   14 D = D + DD   $   IF(D.GT.0.0) 16,15
   15 D = P/GKK/T   $   GO TO 30
   16 IF(D.GT.DM) 17,18
   17 D = DM  $  GO TO 30
   18 IF(T-TCRT) 19,24,30
   19 IF(P.LT.PS) 20,22
   20 IF(D.GT.DG) 21,30
   21 D = DG  $  GO TO 30
   22 IF(D.LT.DL) 23,30
   23 D = DL  $  GO TO 30
   24 IF(P.LT.PCRT) 25,27
   25 IF(D.LT.DCRT) 30,26
   26 D = DCRT - 0.02  $  GO TO 30
   27 IF(D.GT.DCRT) 30,28
   28 D = DCRT + 0.02
   30 CONTINUE  $  PRINT 41  $  STOP
   31 FINDENF = D   $   RETURN
   32 PRINT 43  $  STOP
   33 FINDENF = DCRT  $  RETURN
   34 FINDENF = DCRT  $  PRINT 42  $  RETURN
   35 FINDENF=DPDT=D2PDT2=0  $  DPDD=GKK*T  $  DPDR=DPDD*DTRP
   36 RETURN   $   END

      FUNCTION FINDTMF(P)
C    GIVEN P ON THE MELTING LINE, FIND T FOR NBUTANE.
      COMMON/1/AL,BE,GA,DE,EP,ET, DCRT,TCRT,PCRT, DGAT,DTRP,TTRP,PTRP
```

```
      DATA (A=3634.0),(E=2.210)
    1 X = (P-PTRP)/A + 1  $  FINDTMF = TTRP*X**(1.0/E)  $  RETURN $ END

      FUNCTION FINDTSF(P)
C    GIVEN VAPOR PRESSURE P, ITERATE T TO MINIMIZE (P-PC).
      COMMON/1/AL,BE,GA,DE,EP,ET, DCRT,TCRT,PCRT, DGAT,DTRP,TTRP,PTRP
      COMMON/3/DPDT,D2PDT2,DPSDT,DPMDT,DPDD,DPDR,DTSDR,DTHDR,DDSDT
    1 FORMAT(1H0 9X *FINDTSF = 0,  FAILS TO CONVERGE. * / )
    2 FORMAT(1H0 9X *FINDTSF = 0,  P EXCEEDS PCRT. * / )
    3 IF(P-PCRT) 4,11,12
    4 T = 300  $  DO 9 J=1,50  $  DP = P - PSATF(T)  $  ADP = ABS (DP)
    5 IF(ADP/P-1.0E-7) 10,6,6
    6 IF(ADP/DPSDT/T-1.0E-7) 10,7,7
    7 T = T + DP/DPSDT  $  IF(T-TCRT) 9,9,8
    8 T = TCRT
    9 CONTINUE  $  PRINT 1  $  STOP
   10 FINDTSF = T   $   RETURN
   11 FINDTSF = TCRT   $   RETURN
   12 PRINT 2  $  STOP  $  END

      SUBROUTINE GENEOUS
C    GIVEN P,T FOR THE HOMOGENEOUS DOMAIN -
C    GET DEN AND FUNCTIONS AT ANY TEMPERATURE.
      COMMON/3/DPDT,D2PDT2,DPSDT,DPMDT,DPDD,DPDR,DTSDR,DTHDR,DDSDT
      COMMON/8/ IN,IK, P,T,DEN, E,H,S, CV,CP,CSAT, W,WK
      COMMON/11/ DELS, DELCV
      COMMON/99/ TI,EZZ, EZ,SZ,CVZ, HZ,CPZ
      DATA (Q=1.01325),(G=0.083145)
    3 TI = T  $  CALL IDEAL  $  IF(P.GT.0) 4,10
    4 DEN = DB = FINDENF(T,P)  $  M = 15  $  DA = L = 0
    5 E = EZZ + EZ + EDELF(L,M,T,DA,DB)  $  H = E + 100*P/DB
    6 S = SZ + DELS - 100*G*ALOG(G*T*DB/Q)
    7 CV = CVZ + DELCV   $   PX = PVTF(T,DB,1)
    8 CP = CV + 100*T/DPDD*(DPDT/DB)**2
    9 W = SQRT(WK*CP*DPDD/CV)   $   RETURN
   10 DEN=S=0  $  E = EZZ + EZ  $  H = E + 100*G*T  $  CV=CVZ $ CP=CPZ
   12 W = SQRT(WK*CP*G*T/CV)   $   RETURN  $  END

      SUBROUTINE GENIUS
C    VALID ONLY FOR THE HOMOGENEOUS DOMAIN.
C    SAVES COMPUTER TIME WHEN TABULATING FUNCTIONS ALONG ISOBARS.
C    SAVES DEN,E,S,CV ALONG ISOBARS FOR USE IN INTEGRATING TO NEXT
C    HIGHER ISOBAR. VALID ONLY FOR MONOTONICALLY INCREASING ISOBAR
C    PRESSURES, AND AT TEMPS. T = INTEGER MULTIPLES OF 10 K.
      COMMON/3/DPDT,D2PDT2,DPSDT,DPMDT,DPDD,DPDR,DTSDR,DTHDR,DDSDT
      COMMON/8/ IN,IK, P,T,DEN, E,H,S, CV,CP,CSAT, W,WK
      COMMON/11/ DELS, DELCV
      DIMENSION DK(70),EK(70),SK(70),CK(70)
    1 FORMAT(1H0 9X *GENIUS T NOT INTEGRAL. * / )
    2 J = T/10   $   IF(T - 10*J) 3,4
    3 CALL GENEOUS   $   RETURN
    4 IF(IK.EQ.IN) 5,9
    5 CALL GENEOUS
    6 DK(J) = DEN  $  EK(J) = E  $  SK(J) = S  $  CK(J)=CV  $  RETURN
C    INTEGRATE FROM OLD DEN UP TO NEW DEN ON GIVEN ISOTHERM.
```

```
    9 DA = DK(J)  $  DK(J) = DEN = DB = FINDENF(T,P)  $  N = 14
   11 EK(J) = E = EK(J) + EDELF(1,N,T,DA,DB)  $  H = E + 100*P/DB
   13 SK(J) = S = SK(J) + DELS  $  CK(J) = CV = CK(J) + DELCV
C    NOW GET NEW DP/DT, DP/DD, CP, W.
   15 PX = PVTF(T,DB,1)  $  CP = CV + 100*T/DPDD*(DPDT/DB)**2
   30 W = SQRT(WK*CP*DPDD/CV)   $   RETURN  $  END

      FUNCTION HSATF(T)
C     NBUTANE SATLIQ ENTHALPY, J/MOL.
C    DEFINE YH # (H-HC)/(HT-HC),  X # (TC-T)/(TC-TT),  WHEN -
C    YH = X + (XE-X)*(A1 + A2*X + A3*X2 + . . .)
      DIMENSION AH(8)
      DATA (NFH=8),(EH=0.29),(TTRP=134.86),(TCRT=425.16)
      DATA (HTRP = 0.001),(HCRT = 45399.788)
      DATA (AH = 0.1929773377, 0.3998984487, -0.05499361241,
     1 -1.020568625, 2.872789244, -4.052610155, 2.696377850,
     2 -0.6834388986)
    1 FORMAT(1H0 9X 3HT =F10.5, * IN HSATF(T).*/)
    2 IF(T.GT.TCRT) 3,4
    3 PRINT 1, T  $  STOP
    4 X = (TCRT-T)/(TCRT-TTRP)  $  IF(X.LE.0) 5,6
    5 HSATF = HCRT   $   RETURN
    6 V = X**EH - X  $  FX = X  $  DO 7 K=1,NFH
    7 FX = FX + V*AH(K)*X**(K-1)
    8 HSATF = HCRT - (HCRT-HTRP)*FX   $   RETURN  $  END

      SUBROUTINE IDEAL
C    N-BUTANE, VIA DATA OF CHEN ET AL (1975).
C    CPZ/R = 4 + (A1 + A2/X + A3/X2 + . . )*EXP(-E/X),   X # T/100.
      COMMON/99/ TI,EZZ, EZ,SZ,CVZ, HZ,CPZ
      DIMENSION A(5)
      DATA (E=2.37),(R=8.3145),(HI=7.7980),(SI=37.3495)
      DATA(A = 41.1109726, -139.304011, 257.297067, -170.730596,
     1 40.0321709)
    1 NK = 5   $  XI = TI/100  $  XP = EXP(-E/XI)
    2 CP = 4.0  $  DO 3 K=1,NK
    3 CP = CP + A(K)*XP*XI**(1-K)
C    NUMERICAL INTEGRATION FOR HZ/R, SZ/R  -
    5 H = S = 0  $  N = ABS(TI-300)/4 + 4   $   DX = (XI-3)/N
    6 DO 10 J=1,N  $  X = 3.0 + (J-0.5)*DX  $  XP = EXP(-E/X)
    7 CPX = 4.0  $  DO 8 K=1,NK
    8 CPX = CPX + A(K)*XP*X**(1-K)
    9 H = H + CPX*DX   $   S = S + CPX*DX/X
   10 CONTINUE  $  H = (HI*3 + H)/XI  $  S = SI + S
C    CONVERT TO JOULES, MOLES, KELVINS.
   11 HZ = R*TI*H  $  EZ = HZ - R*TI  $  SZ = R*S
   12 CPZ = R*CP  $  CVZ = CPZ - R   $   RETURN  $  END

      SUBROUTINE ISOTHRM
C    PRINTOUT THE CRITICAL ISOTHERM.
      COMMON/1/AL,BE,GA,DE,EP,ET, DCRT,TCRT,PCRT, DGAT,DTRP,TTRP,PTRP
      COMMON/3/DPDT,D2PDT2,DPSDT,DPMDT,DPDD,DPDR,DTSDR,DTHDR,DDSDT
      COMMON/4/XB1,XB2, XC1,XC2, XE1,XE2, DXBDR,DXCDR,DXEDR
      COMMON/6/ TSAT, THETA, PSAT
```

```
      DATA (WM = 58.1243)
    1 FORMAT(1H1 14X *THE CRITICAL ISOTHERM, NBUTANE* //
     1 6X6HTC,K = F7.2, 12H, DC,KG/M3 = F9.4, 10H, PC,MPA = F10.7/ 6X
     2 *AT THE C.P., DPS/DT =*F9.6, 9H, DP/DT =F9.6, * MPA/K.* //
     3 6X4HD/DC 9X5HTS/TC 9X5HPS/PC 10X4HP/PC 9X5HDP/DR 4X6HDTS/DR
     4 4X6HDTH/DR 4X6HDPS/DR 4X6HDXB/DR 4X6HDXC/DR )
    2 FORMAT(2X F8.3, 3F14.10, F14.9, 5F10.5)
    3 PC = PVTF(TCRT,DCRT,0)  $  PCS = PCRT/10  $  DCS = DCRT*WM
      DPST = DPSDT/10   $   DPT = DPDT/10
    4 PRINT 1, TCRT, DCS, PCS, DPST, DPT  $  DO 8 J=1,41
    5 DR = 0.895 + 0.005*J  $  DN = DR*DCRT
    6 PR = PVTF(TCRT,DN,1)/PCRT  $  DPSDR = DPSDT*DTSDR
    7 TSN = TSAT/TCRT  $  PSN = PSAT/PCRT
      DPDR = DPDR/10   $   DPSDR = DPSDR/10
    8 PRINT 2, DR, TSN,PSN, PR,DPDR, DTSDR,DTHDR,DPSDR, DXBDR,DXEDR
    9 RETURN   $   END

      SUBROUTINE JTLOCUS
C    THE JOULE-THOMSON P-V-T LOCUS FOR NBUTANE.
C    DERIVE THE J-T INVERSION CURVE.  USE ROUTINE DELTAF(T,DI).
      COMMON/1/AL,BE,GA,DE,EP,ET,  DCRT,TCRT,PCRT, DGAT,DTRP,TTRP,PTRP
      DIMENSION DK(60),DN(60),TT(60),PP(60)
      DATA (A=1.2275),(B=0.485),(WM=58.1243)
    1 FORMAT(1H1 16X *THE JOULE-THOMSON INVERSION LOCUS FOR NBUTANE* //
     2 17X 3HT,K 8X2HDI 5X5HKG/M3 5X5HP,MPA
     3  7X 3HT,K 8X2HDI 5X5HKG/M3 5X5HP,MPA )
    2 FORMAT(10X I10, 2F10.1, F10.3,   I10, 2F10.1, F10.3)
C    SAVE INITIAL, TRIAL DENSITY, DK(I) = DI.
    5 TA = 340   $   NP = 52
    6 PRINT 1  $  DO 25 I=1,NP  $  DX = 0.4
    7 T = TA + 10*I  $  X = T/TCRT  $  DK(I) = DI = DCRT*EXP(A-B*X)
   10 IF(T-TCRT) 11,12,12
   11 DL = DENLIQF(T)  $  IF(DI.LT.DL) 23,12
   12 SS = DELTAF(T,DI)  $  DO 20 IT=1,14
   14 D=DI-DX $ SL=DELTAF(T,D)   $   D=DI+DX $ SP=DELTAF(T,D)
   15 IF(SS-SL) 18,16,16
   16 IF(SP-SL) 19,17,17
   17 SS = SL  $  DI = DI - DX  $  GO TO 20
   18 IF(SS-SP) 20,20,19
   19 SS = SP  $  DI = DI + DX
   20 DX = DX/2  $  TT(I) = T  $  DN(I) = DI  $  PP(I) = PVTF(T,DI,0)
   21 GO TO 25
   23 TT(I) = T  $  DK(I) = DN(I) = PP(I) = 0
   25 CONTINUE   $   N = NP/2
   26 DO 35 J=1,N   $   K = J + N
   27 IT = TT(J)  $  ITT = TT(K)
   28 DKJ = WM*DK(J)  $  DNJ = WM*DN(J)
   29 DKK = WM*DK(K)  $  DNK = WM*DN(K)
   30 PPJ = PP(J)/10  $  PPK = PP(K)/10
   35 PRINT 2, IT, DKJ,DNJ, PPJ,  ITT,DKK,DNK,PPK
   40 RETURN   $   END

      SUBROUTINE PEEK
C    EXAMINE BEHAVIOR OF THE PVT COEFFICIENTS.
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C     B(S) # B1 + B2*S2,  E(S) # E1*(S-1)*(S-ER)*EXP(-GA*S**IX).
C     WHERE,   R # DEN/DTRP,  S # DEN/DCRT.
      COMMON GK,GKK, B1,B2,B3,B4,B5, C1,C2,C3, E1,E2,E3, ER,IX
      COMMON/1/AL,BE,GA,DE,EP,ET, DCRT,TCRT,PCRT, DGAT,DTRP,TTRP,PTRP
      COMMON/3/DPDT,D2PDT2,DPSDT,DPMDT,DPDD,DPDR,DTSDR,DTHDR,DDSDT
      COMMON/6/ TSAT, THETA, PSAT
      DATA (WM = 58.1243),(EX = 1.10)
    4 FORMAT(1H1 14X *EQUATION OF STATE COEFFS., NBUTANE * //
     1 15X 6HTTRP =F7.3, 8H, TBLP =F9.4, 8H, TCRT =F8.3, * K* /
     2 15X 6HPTRP =E12.6, 8H, PBLP =F8.6, 8H, PCRT =F9.6, * MPA* /
     3 15X 6HDTRP =E11.5, 8H, DLBP =E11.5, 8H, DCRT =E11.5, * KG/M3* /
     3 15X 6HDGAT =E11.5, 8H, DGBP =E11.5, * KG/M3* /
     3 15X *DPS/DTB,MPA/K =* E11.5, *, QVAPB,KJ/MOL =* F7.3//
     4 15X 4HIX =I2, 6H, EX =F5.2, 6H, ER =F5.2, *, S # DEN/DCRT* /
     5 15X 4HAL =F10.7, 6H, BE =F10.7, 6H, GA =F10.7/
     6 15X 4HDE =F10.7, 6H, EP =F10.7, 6H, ET =F10.7//
     7 15X 4HB1 =F14.11, 6H, B2 =F14.11, 6H, B3 =F14.11/
     8 15X 4HC1 =F14.11, 6H, C2 =F14.11, 6H, C3 =F14.11/ )
    5 FORMAT(15X 4HD/DC 6X4HTSAT 5X5HTHETA 4X6HPS,MPA 9X1HB 9X1HC )
    6 FORMAT(9X F10.2, 2F10.3, F10.4, 2F10.5)
    8 TB=FINDTSF(1.01325) $ DGB=DENGASF(TB) $ DLB=DENLIQF(TB)
    9 QB = TB*DPSDT*(1/DGB - 1/DLB)/10.0
      PTR = PTRP/10  $  PBLP = 0.101325  $  PCR = PCRT/10
      DTR = DTRP*WM  $  DLBI = DLB*WM  $  DCR = DCRT*WM
      DGA = DGAT*WM  $  DGBI = DGB*WM  $  DPSB = DPSDT/10
   10 PRINT 4, TTRP,TB,TCRT,PTR,PBLP,PCR,DTR,DLBI,DCR,DGA,DGBI,DPSB,QB,
     1 IX,EX,ER, AL,BE,GA,DE,EP,ET, B1,B2,B3, E1,E2,E3
   11 PRINT 5  $  N = 10*DTRP/DCRT + 1
   12 DO 20 J=1,N   $   S = 0.1*J
   13 DN = S*DCRT  $  S2=S*S  $  SN=S-1  $  SX = S**IX
   14 SR = 1  $  IF(ER.GT.0)  SR = S-ER
   16 B = B1 + B2*S2
   17 E = (E1 + E2*S)*SN*SR*EXP(-GA*SX)
   19 TSAT=TS=TSATF(DN)  $  TH=THETAF(DN)  $  PS=PSATF(TS) $ PIS=PS/10
   20 PRINT 6, S, TS,TH,PIS, B,E  $  RETURN  $  END

      FUNCTION PMELTF(T)
C     NBUTANE MELTING LINE, BAR, VIA REEVES, SCOTT, AND BABB(JR),
C     J. CHEM. PHYS. 40(12), 3662 (1964).
      COMMON/1/AL,BE,GA,DE,EP,ET, DCRT,TCRT,PCRT, DGAT,DTRP,TTRP,PTRP
      COMMON/3/DPDT,D2PDT2,DPSDT,DPMDT,DPDD,DPDR,DTSDR,DTHDR,DDSDT
      DATA (A = 3634.0),(E = 2.210)
    1 X = T/TTRP  $  XE = X**E  $  PMELTF = PTRP + A*(XE-1)
    2 DPMDT = A*E*XE/X/TTRP   $   RETURN  $  END

      FUNCTION PSATF(T)
C     NBUTANE VAPOR PRESSURE, BAR, RDG, FEB. 19, 1981.  (DCRT=3.92).
C     LN(P) = P1/X + P2 + P3*X + P4*X2 + P5*X3 + P6*(1-X)**EPP.
      COMMON/3/DPDT,D2PDT2,DPSDT,DPMDT,DPDD,DPDR,DTSDR,DTHDR,DDSDT
      DIMENSION PJ(6)
      DATA (EPP = 1.85)
      DATA (TTRP=134.86),(TCRT=425.16),(DCRT=3.92),(DTRP=12.65)
      DATA(PJ = -9.50924729, 5.20153488, 10.64095231,
     1 4.86147936, -7.55818629, 18.72886023)
```

```
    1 FORMAT(1H0 9X *T ABOVE TCRT IN PSATF(T). * / )
    4 X = T/TCRT  $  V = 1.0 - X  $  IF(V) 7,8,9
    7 PRINT 1   $   STOP
    8 Z = Z1 = 0  $  GO TO 10
    9 Z = V**EPP  $  Z1 = -EPP*Z/V
   10 PL = PJ(6)*Z   $   PL1 = PJ(6)*Z1
   11 DO 13 K=1,5  $  L = K-2  $  XL = X**L
   12 PL = PL + PJ(K)*XL  $  PL1 = PL1 + PJ(K)*L*XL/X
   13 CONTINUE   $   PSATF = EXP(PL)
   15 DPSDT = PL1*PSATF/TCRT   $   RETURN  $  END

      SUBROUTINE PVTDATA
C    NBUTANE EOS CONSTANTS, RDG/NBS, FEB. 19, 1981.  (DCRT=3.92).
      COMMON GK,GKK, B1,B2,B3,B4,B5, C1,C2,C3, E1,E2,E3, ER, IX
      COMMON/1/AL,BE,GA,DE,EP,ET, DCRT,TCRT,PCRT, DGAT,DTRP,TTRP,PTRP
      COMMON/8/ IN,IK, P,T,DEN, E,H,S, CV,CP,CSAT, W,WK
      COMMON/12/ZCRT,ZCALC,DZDT, ZSAT,DZSDT, ZFX, FRT,DFRTDT
      COMMON/99/ TI,EZZ, EZ,SZ,CVZ, HZ,CPZ
   10 WM = 58.1243  $  TTRP = 134.86  $  TCRT = 425.16
   12 DCRT = 3.92   $   DTRP = 12.650
   13 PTRP = PSATF(TTRP)  $  PCRT = PSATF(TCRT)
   20 GKK = 0.083145  $  GK = GKK*DCRT  $  ZCRT = PCRT/DCRT/GKK/TCRT
   21 IX = 2  $  AL = 1.0  $  BE = 0.7  $  GA = 0.14  $  DE = 0
   22 EP = 0  $  ER = 2.20  $  ET = 1.1
   23 B1 = 0.45655869162   $   B2 = 0.17143942370
   24 E1 =-0.28036114629   $   B3=B4=E2=E3=0
   25 DGAT = DENGASF(TTRP)  $  WK = 100000/WM  $  EZZ = 22644.306
   99 RETURN   $   END

      FUNCTION PVTF(T,D,M)
C    NBUTANE EQNSTATE, PVTF = P,BAR. SIMPLIFIED, FEB. 12, 1981.
C    NOTE, M=0 RETURNS DP/DT, D2P/DT2.  M=1 RETURNS ALSO DP/DD.
C    P-PSAT = S*GK*(T-TSAT) + S*S*GK*TCRT*F(S,T),  WHERE -
C    F(S,T) # B(S)*XBF(S,T) + E(S)*XEF(S,T),  AND -
C    B(S) # B1 + B2*S2,  E(S) # E1*(S-1)*(S-ER)*EXP(-GA*S**IX).
C    WHERE,   R # DEN/DTRP,  S # DEN/DCRT.
      COMMON GK,GKK, B1,B2,B3,B4,B5, C1,C2,C3, E1,E2,E3, ER,IX
      COMMON/1/AL,BE,GA,DE,EP,ET, DCRT,TCRT,PCRT, DGAT,DTRP,TTRP,PTRP
      COMMON/3/DPDT,D2PDT2,DPSDT,DPMDT,DPDD,DPDR,DTSDR,DTHDR,DDSDT
      COMMON/4/XB1,XB2, XC1,XC2, XE1,XE2, DXBDR,DXCDR,DXEDR
      COMMON/6/ TSAT, THETA, PSAT
      COMMON/12/ZCRT,ZCALC,DZDT, ZSAT,DZSDT,ZFX, FRT,DFRTDT
    1 S = D/DCRT  $  S2=S*S  $  SN=S-1  $  SR=S-ER  $  SX=S**IX
    5 GK = DCRT*GKK  $  TC = TCRT  $  DSDR = DTRP/DCRT
    6 RG = S*GK   $   GKT = GK*TC
    7 TSAT=TS=TSATF(D)  $  PSAT=PS=PSATF(TS)  $  THETA=THETAF(D)
    8 XB = XBF(T,D)   $   XE = XEF(T,D)
    9 B = B1*S2 + B2*S2*S2
   10 XP = EXP(-GA*SX)  $  SM = S2*SN*SR  $  E = E1*SM*XP
   12 F = B*XB + E*XE  $  F1 = B*XB1 + E*XE1  $  F2 = B*XB2 + E*XE2
   13 PVTF = PS + RG*(T-TS) + GKT*F  $  FRT=F/S2  $  DFRTDT=F1/S2/TC
   14 DPDT = RG + GK*F1  $  D2PDT2 = GK*F2/TC   $   IF(M) 15,30
   15 BD = (2*B1 + 4*B2*S2)*S*DSDR
   16 XP1 = -IX*GA*SX/S  $  SM1 = (SN+SR)*S2 + 2*S*SN*SR
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   18 ED = E1*(SM*XP1 + SM1)*XP*DSDR
   20 F1 = B*DXBDR + BD*XB   +   E*DXEDR + ED*XE
   26 DPDR = (DPSDT-RG)*DTSDR + (T-TS)*GK*DSDR + GKT*F1
   27 DPDD = DPDR/DTRP
   30 RETURN   $   END

      FUNCTION QVAPXF(T)
C    QVAP = A1*X + (XE-X)*(A2 + A3*X + A4*X2 + . . ).
C    X # (TC-T)/(TC-TT),   XE # X**E.
      DIMENSION AQ(4)
      DATA (NFQ=4),(EQ=0.34),(TTRP=134.86),(TCRT=425.16)
      DATA (AQ = 28.789248, 24.163103, 12.710873, -16.533537)
    1 FORMAT(1H0 9X *T EXCEEDS TCRT IN QVAPXF(T). * / )
    2 IF(TCRT-T) 3,4,5
    3 PRINT 1   $   STOP
    4 QVAPXF = 0  $  RETURN
    5 XN = TCRT - TTRP  $  X = (TCRT-T)/XN  $  XE = X**EQ
    6 F = 0  $  DO 7 K=2,NFQ
    7 F = F + AQ(K)*X**(K-2)
    9 Q = AQ(1)*X + (XE-X)*F
   10 QVAPXF = Q*1000   $   RETURN  $  END

      SUBROUTINE SIMPLE
C    FOR ANY GIVEN T,K AND P,MPA, CONVERT TO P,BAR, AND USE SUBROUTINE
C    THERMO (OR ENTRIES THEREIN) TO GET THERMOPHYSICAL PROPERTIES.
C    THEN CONVERT TO MPA, AND KG/M3 IN PRESENT ROUTINE.
      COMMON/3/DPDT,D2PDT2,DPSDT,DPMDT, DPDD,DPDR,DTSDR,DTHDR,DDSDT
      COMMON/8/ IN,IK, P,T,DEN, E,H,S, CV,CP,CSAT, W,WK
      COMMON/99/ TI,EZZ, EZ,SZ,CVZ, HZ,CPZ
      DATA (R=0.083145),(GJ=8.3145),(PA=1.01325),(WM=58.1243)
   14 FORMAT(1H1 18X *TEST OF THERMO AT P,MPA =* F8.5/
     1 19X *DENSITIES KG/M3, HEATS J/MOL. * / )
   16 FORMAT(6X4HPMPA 9X1HT 6X3HDEN 8X1HZ 5X5HDP/DT 5X5HDP/DD
     1 8X1HE 8X1HH 8X1HS 6X2HCV 6X2HCP 5X1HW 9X3HF/P 5X4HDIEL )
   17 FORMAT(1X F9.4, F10.3, F9.2, F9.5, F10.5, F10.6, 2F9.1, F9.3,
     1 2F8.2, I6, E12.5, F9.5)
C    LET US EXAMINE A SUBCRITICAL ISOBAR.
   19 PMPA = 3.5
   20 P = 10*PMPA  $  PRINT 14, PMPA  $  PRINT 16
   21 DO 90 J=1,39  $  TIK = T = 130 + 10*J
   22 CALL THERMO   $   IW = W  $  Z = P/DEN/R/T
C    GET DIEL.CONST., AND FUGACITIES.
   25 GIB = H-EZZ-HZ -T*(S-SZ)  $  FOP = EXP(GIB/GJ/T)*PA/P
   26 IF(T.GT.450) 27,28
   27 DIE = 0  $  GO TO 30
   28 DIE = DIELF(DEN,T,P)
C    CONVERT PRESSURES, DENSITIES, AND DERIVATIVES.
   30 PMPA=P/10 $ DEN=DEN*WM $ DPDT=DPDT/10 $ DPDD=DPDD/10/WM
   31 DPMDT = DPMDT/10  $  DPSDT = DPSDT/10  $  DDSDT = DDSDT*WM
   40 PRINT 17, PMPA,T,DEN,Z, DPDT,DPDD, E,H,S, CV,CP,IW, FOP,DIE
   90 CONTINUE   $   RETURN   $   END

      FUNCTION SSATF(T)
C     NBUTANE SATLIQ ENTROPY, J/MOL/K.
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C     CONSTRAINED AT TRIPLE AND CRITICAL POINTS.
C     Y # (S-SCRT)/(STRP-SCRT),  X # (TC-T)/(TC-TT).
C     Y = X + (XE-X)*(A1 + A2*X + A3*X2 + . . . ).
      DIMENSION AS(6)
      DATA (NFS=6),(ES=0.23),(TTRP=134.86),(TCRT=425.16)
      DATA (STRP = 133.54372),(SCRT = 297.64652)
      DATA (AS = 0.08883444348, -0.3470304947, 0.2093724392,
     1 -0.9568328496, 0.9579992545, -0.6534607056)
    1 FORMAT(1H0 9X 3HT =F10.5, * IN SSATF(T). * / )
    2 IF(TCRT-T) 3,4,5
    3 PRINT 1, T   $   STOP
    4 SSATF = SCRT   $   RETURN
    5 YN = STRP-SCRT  $  XN = TCRT-TTRP
    6 X = (TCRT-T)/XN  $  XE = X**ES  $  V = XE - X
    7 Y = X  $  DO 8 K=1,NFS
    8 Y = Y + V*AS(K)*X**(K-1)
    9 SSATF = SCRT + YN*Y   $   RETURN   $   END

      SUBROUTINE TABLIQ
      COMMON/1/AL,BE,GA,DE,EP,ET, DCRT,TCRT,PCRT, DGAT,DTRP,TTRP,PTRP
      COMMON/3/DPDT,D2PDT2,DPSDT,DPMDT,DPDD,DPDR,DTSDR,DTHDR,DDSDT
      COMMON/6/ TSAT, THETA, PSAT
      COMMON/8/ IN,IK, P,T,DEN, E,H,S, CV,CP,CSAT, W,WK
      COMMON/9/DNG,EG,HG,SG, CVG,CPG,WG, DPGDT,DPGDD
      COMMON/12/ZCRT,ZCALC,DZDT, ZSAT,DZSDT,ZFX, FRT,DFRTDT
      COMMON/99/ TI,EZZ, EZ,SZ,CVZ, HZ,CPZ
      DIMENSION DSA(60),TSA(60),PSA(60),DLT(60),DPT(60),DPD(60)
      DATA (G=0.083145),(WM=58.1243)
    4 FORMAT(1H1 13X *PROPERTIES OF SATURATED LIQUID NBUTANE* //
     1 14X 1HT 11X1HP 3X5HDEN,L 7X5HDEN,G 5X3HZ,L 5X3HZ,G
     2 5X6HDPS/DT 3X6HDDL/DT 3X5HDP/DT 6X5HDP/DD /
     3 14X 1HK 9X3HMPA 3X5HKG/M3 7X5HKG/M3  16X
     4 6X5HMPA/K 2X7HKG/M3/K 3X5HMPA/K 2X9HMPA-M3/KG )
    5 FORMAT(5XF10.3, E12.5, F8.2, E12.5, 2F8.5, E11.4,F9.4,F8.4,E11.4)
   11 FORMAT(1H1 13X *PROPERTIES OF SATURATED LIQUID NBUTANE * //
     1 14X 1HT 4X5HQ,VAP 8X1HE 8X1HH 8X1HS
     2 6X2HCV 6X2HCS 6X2HCP 6X3HF/P 6X1HW 4X5HDIEL. /
     3 14X 1HK 4X5HJ/MOL 4X5HJ/MOL 4X5HJ/MOL 2X7HJ/MOL/K
     4 1X7HJ/MOL/K 1X7HJ/MOL/K 1X7HJ/MOL/K 11X 5HM/SEC 4X5HCONST )
   12 FORMAT(5X F10.3, 3F9.1, F9.3, 3F8.2, F9.5, I7, F9.5)
C     FOR PAGE ONE OF TABLIQ.
C     REPLACE T = 230 BY B.P. AT J = 30.
  120 NP = 59   $   PRINT 4
  121 DO 150 J=1,NP  $  IF(J.EQ.1) 122,123
  122 T = TTRP  $  GO TO 139
  123 IF(J.EQ.29) 124,125
  124 T = FINDTSF(1.01325)  $  GO TO 139
  125 IF(J.EQ.NP) 126,128
  126 T = TCRT  $  DSA(J)=DG=DL=DCRT  $  DLT(J) = DDLDT = 0
  127 VG = VL = 1.0/DCRT  $  ZG = ZCRT  $  GO TO 141
  128 T = 130 + 5*J
  139 DSA(J) = DL = DENLIQF(T)  $  DLT(J) = DDLDT = DDSDT
  140 DG = DENGASF(T)  $  ZG = ZSAT  $  VG = 1/DG  $  VL = 1/DL
  141 TSA(J) = T  $  PX = PVTF(T,DL,1)  $  DPT(J)=DPDT  $  DPD(J)=DPDD
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  147 PSA(J) = PS = PSAT  $  Z = PS/DL/G/T
  148 PS=PS/10 $ DPSDT=DPSDT/10 $ DPDT=DPDT/10 $ DPDD=DPDD/10
  149 DL=DL*WM $ DG=DG*WM $ DDLDT=DDLDT*WM  $  DPDD = DPDD/WM
  150 PRINT 5, T,PS, DL,DG, Z,ZG, DPSDT,DDLDT, DPDT,DPDD
C    PAGE 2, TABLIQ.  AVOID COEXIST, TIMESAVER.
C    USE COEXIST AT ALL TEMPERATURES.
  160 PRINT 11  $  DO 180 J=1,NP  $  T = TSA(J)  $  P = PSA(J)
  161 CALL COEXIST  $  DL = DEN  $  IW = W
  162 DIEL = DIELF(DL,T,P)  $  QX = QVAPXF(T)
C    GET FUGACITY COEF., (F/P), VIA HZ, SZ, HG, SG.
C    NOTE, DI = 0.00001 MOL/L IN EDELF.
  170 GIBS = HG-EZZ-HZ - T*(SG-SZ)
  171 GJ = 100*G  $  XP = EXP(GIBS/GJ/T)  $  FOP = XP*1.01325/P
  172 IF(DNG.LE.0.00001)  FOP = 1.0
  180 PRINT 12, T,QX, E,H,S, CV,CSAT,CP, FOP, IW, DIEL
  999 RETURN    $    END

      SUBROUTINE THERMO
C    FOR COMPUTATION AT ANY (T,P) POINT.
C    ASSUMES AN ISOTHERM IN SINGLE-PHASE ONLY.
C    CASES FOR ISOTHERMS BELOW, EQ., ABOVE TCRT.
C    GIVEN (T,P), RETURNS DEN, E,H,S, CV,CP,W, DPDT, DPDD.
C    ENTRIES BELOW FOR PHASE BOUNDARIES ASSUME A GIVEN ISOBAR P, OR -
C    ENTRIES BELOW FOR PHASE BOUNDARIES ASSUME A GIVEN ISOTHERM, T.
      COMMON/1/AL,BE,GA,DE,EP,ET, DCRT,TCRT,PCRT, DGAT,DTRP,TTRP,PTRP
      COMMON/3/DPDT,D2PDT2,DPSDT,DPMDT,DPDD,DPDR,DTSDR,DTHDR,DDSDT
      COMMON/8/ IN,IK, P,T,DEN, E,H,S, CV,CP,CSAT, W,WK
      COMMON/9/ DNG,EG,HG,SG, CVG,CPG,WG, DPGDT,DPGDD
      COMMON/99/ TI,EZZ, EZ,SZ,CVZ, HZ,CPZ
    1 FORMAT(1HO 9X *THERMO, P.GE.PMELT. * / )
    2 FORMAT(1HO 9X *THERMO DOUBLE-VALUED AT P = PSAT. * / )
    3 FORMAT(1HO 9X *THERMO, DEN GE. DCRT AT T = TCRT. * / )
   10 IF(T-TCRT) 11,20,25
C    SUBCRITICAL ISOTHERMS.
   11 PM = PMELTF(T)  $  IF(P.GE.PM) 12,13
   12 PRINT 1  $  CALL COMPRLQ  $  TI=T  $  CALL IDEAL   $   RETURN
   13 PS = PSATF(T)  $  IF(P-PS) 14,15,16
   14 CALL GENEOUS   $   RETURN
   15 PRINT 2   $   RETURN
   16 CALL COMPRLQ  $  TI = T  $  CALL IDEAL  $  RETURN
C    THE CRITICAL ISOTHERM.
   20 CALL GENEOUS   $   IF(DEN.LT.DCRT)  RETURN
   21 CP = CV = W = 0  $  PRINT 3  $  RETURN
C    ISOTHERMS AT T ABOVE TCRT.
   25 CALL GENEOUS   $   RETURN
C    THERMOM FOR GIVEN ISOBAR AT THE MELTING LINE, GET T.
C    RETURNS T,DEN, E,H,S, CV,CP,W, DPMDT,DPDT,DPDD.
      ENTRY THERMOM
   40 T = FINDTMF(P)  $  PM = PMELTF(T)  $  CALL COMPRLQ
   41 TI = T  $  CALL IDEAL  $  RETURN
C    THERMOL FOR GIVEN ISOBAR AT SATURATED LIQUID LINE, GET T.
C    RETURNS T,DEN, E,H,S, CV,CP,CSAT,W, DPSDT,DDSDT, DPDT,DPDD.
      ENTRY THERMOL
   43 T = FINDTSF(P)  $  CALL COEXIST  $  RETURN
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C     THERMOV FOR GIVEN ISOBAR AT THE SATURATED VAPOR LINE, GET T.
C     RETURNS T,DEN, E,H,S, CV,CP,W, DPSDT,DDSDT, DPDT,DPDD.
       ENTRY THERMOV
   45 T = FINDTSF(P)  $  CALL COEXIST  $  DEN=DNG $ E=EG $ H=HG $ S=SG
   47 CV=CVG $ CP=CPG $ W=WG $ DPDT=DPGDT $ DPDD=DPGDD  $  RETURN
C     THRMM FOR ISOTHERM AT THE MELTING LINE, GET P.
C     RETURNS P,DEN, E,H,S, CV,CP,W, DPMDT, DPDT, DPDD.
       ENTRY THRMM
   50 P = PMELTF(T)  $  CALL COMPRLQ $ TI=T $ CALL IDEAL $ RETURN
C     THRML FOR ISOTHERM AT SAT. LIQ. LINE, GET P.
C     RETURNS P,DEN, E,H,S, CV,CP,CSAT,W, DPSDT,DDSDT, DPDT,DPDD.
       ENTRY THRML
   55 P = PSATF(T)  $  CALL COEXIST   $   RETURN
C     THRMV FOR ISOTHERM AT SAT. VAPOR LINE, GET P.
C     RETURNS P,DEN, E,H,S, CV,CP,W, DPSDT,DDSDT, DPDT,DPDD
       ENTRY THRMV
   60 P = PSATF(T)  $  CALL COEXIST
   61 DEN=DNG $ E=EG $ H=HG $ S=SG $ CV=CVG
   62 CP=CPG $ W=WG $ DPDT=DPGDT $ DPDD=DPGDD
   99 RETURN   $   END

       FUNCTION THETAF(DEN)
C     THETA = TSAT*EXP(U(S)).
C     LET Q = (S-1)/(ST-1),  WHERE ST = DTRP/DCRT,  THEN -
C     IF S < 1, U = AL*Q**3,    IF S > 1,  U = -AL*Q**3,
       COMMON/1/AL,BE,GA,DE,EP,ET, DCRT,TCRT,PCRT, DGAT,DTRP,TTRP,PTRP
       COMMON/3/DPDT,D2PDT2,DPSDT,DPMDT,DPDD,DPDR,DTSDR,DTHDR,DDSDT
       COMMON/6/ TSAT, THETA, PSAT
    1 S = DEN/DCRT  $  DSDR = DTRP/DCRT  $  C = DSDR-1
    2 Q = (S-1)/C  $  Q2 = Q*Q  $  U = AL*Q*Q2
    3 U1 = AL*3*Q2*DSDR/C   $   IF(Q) 5,9,4
    4 U = -U   $   U1 = -U1
    5 XP = EXP(U)    $   THETAF = TSAT*XP
    6 DTHDR = (TSAT*U1 + DTSDR)*XP    $    RETURN
    9 THETAF = TCRT  $  DTHDR = 0    $    RETURN   $   END

       FUNCTION TSATF(DEN)
C     ITERATE T TO MINIMIZE (DEN-DCALC) VIA DENGASF(T), DENLIQF(T).
C     IF ITERATION FAILS, PRINTOUT ONCE ONLY AND STOP AT K = 2.
       COMMON/1/AL,BE,GA,DE,EP,ET, DCRT,TCRT,PCRT, DGAT,DTRP,TTRP,PTRP
       COMMON/3/DPDT,D2PDT2,DPSDT,DPMDT,DPDD,DPDR,DTSDR,DTHDR,DDSDT
       DATA (Q=2.0),(FN=6.3890561)
C     NOTE,   FN # EXP(Q) - 1.0.
    1 FORMAT(1H1 14X *TSATF(DEN) FAILS AT DEN =* E15.7//
     1 15X 5HDCALC 13X2HDD 10X5HDDSDT 13X2HDT 12X3HT,K )
    2 FORMAT(5X 5E15.7)
    3 K = 0   $   D = DEN
    4 S = D/DCRT  $  YN = TCRT/TTRP-1  $  IF(D-DCRT) 5,30,6
    5 ST=DGAT/DCRT $ F=ALOG(S)/ALOG(ST)*((1-S)/(1-ST))**2 $ GO TO 7
    6 ST=DTRP/DCRT $ U=((S-1)/(ST-1))**3 $ F=(EXP(Q*U)-1)/FN
    7 T = TCRT/(YN*F+1)
    8 DO 20 J=1,50  $  IF(D-DCRT) 9,30,10
    9 DC = DENGASF(T)  $  GO TO 11
   10 DC = DENLIQF(T)
```

```
   11 DD = D - DC  $  IF(ABS(DD/D).LT.1.0E-7) 25,12
   12 DT = DD/DDSDT  $  IF(ABS(DT/T).LT.1.0E-7) 25,13
   13 T = T + DT  $  IF(T) 14,14,15
   14 T = TTRP  $  GO TO 18
   15 IF(T.LT.TCRT) 18,16
   16 T = TCRT - 0.05
   18 IF(K.EQ.1)  PRINT 2, DC, DD, DDSDT, DT, T
   20 CONTINUE  $  K = K+1  $  IF(K.NE.1)  STOP
   21 PRINT 1, DEN   $   GO TO 4
   25 TSATF = T  $  DTSDR = DTRP/DDSDT  $  RETURN
   30 TSATF = TCRT  $  DTSDR = 0  $  RETURN  $  END

      FUNCTION XBF(T,D)
C    XBF(R,T) # (X**BE)*EXP(A*(1-TS/T)) - XS**BE,   WHERE -
C    X # T/TC,  XS # TS/TC,  A # (1-BE) + SQRT(1-BE),
C    XBF = U*EXP(A*V) - US,  U # X**B,  US # XS**B,  V # (1-TS/T).
      COMMON/1/AL,BE,GA,DE,EP,ET, DCRT,TCRT,PCRT, DGAT,DTRP,TTRP,PTRP
      COMMON/3/DPDT,D2PDT2,DPSDT,DPMDT,DPDD,DPDR,DTSDR,DTHDR,DDSDT
      COMMON/4/XB1,XB2, XC1,XC2, XE1,XE2, DXBDR,DXCDR,DXEDR
      COMMON/6/ TSAT, THETA, PSAT
    1 B = BE  $  BN = 1-B  $  A = BN + SQRT(BN)
    2 TC=TCRT $ TS=TSAT $ X=T/TC $ XS=TS/TC $ XS1=DTSDR/TC
    3 U = X**B  $  U1 = B*U/X  $  U2 = -BN*U1/X
    4 US = XS**B  $  US1 = B*US*XS1/XS
    5 V = 1-TS/T  $  V1R = -DTSDR/T  $  V1X = TS/T/X  $  V2X = -2*V1X/X
    6 P = EXP(A*V)  $  P1 = A*P  $  P2 = A*P1
    7 P1R = P1*V1R  $  P1X = P1*V1X  $  P2X = P1*V2X + P2*V1X*V1X
    8 XBF = U*P - US  $  XB1 = U*P1X + U1*P
    9 XB2 = U*P2X + 2*U1*P1X + U2*P  $  DXBDR = U*P1R - US1
   10 RETURN   $   END

      FUNCTION XEF(T,D)
C    ULTRA REVISION, MARCH 29, 1981.
C    XEF = H(R,T)/HS(R) - 1.0,
C    H(R,T) # 1 - (W-WE/E)/1-1/E),   E = ET.
C    X#T/TC, F#TS/T, W#(1-TH/T), WE#W**E
C    A = DE,  B = 1-A,  C = EP,  E = ET.
      COMMON/1/AL,BE,GA,DE,EP,ET, DCRT,TCRT,PCRT, DGAT,DTRP,TTRP,PTRP
      COMMON/3/DPDT,D2PDT2,DPSDT,DPMDT,DPDD,DPDR,DTSDR,DTHDR,DDSDT
      COMMON/4/XB1,XB2, XC1,XC2, XE1,XE2, DXBDR,DXCDR,DXEDR
      COMMON/6/ TSAT, THETA, PSAT
    1 E = ET  $  EK = E/(E-1)  $  TC = TCRT
    2 TS = TSAT  $  TH = THETA  $  X = T/TC
    3 W = 1.0 - TH/T  $  IF(W) 30,30,4
    4 CONTINUE
    5 W1R = -DTHDR/T  $  W1X = TH/T/X  $  W2X = -2*W1X/X
    6 WE = W**E  $  WE1 = E*WE/W  $  WE1R = WE1*W1R
    7 WE1X = WE1*W1X  $  WE2X = WE1*W2X + (E-1)*WE1*W1X*W1X/W
    8 H = 1 - EK*(W-WE/E)  $  H1R = -EK*(W1R-WE1R/E)
    9 H1X = -EK*(W1X-WE1X/E)  $  H2X = -EK*(W2X-WE2X/E)
   10 WS = 1.0 - TH/TS  $  IF(WS) 11,11,12
   11 HS = 1  $  HS1 = 0  $  GO TO 16
   12 WS1 = (TH*DTSDR/TS - DTHDR)/TS
   13 WSE = WS**E  $  WSE1 = E*WSE*WS1/WS
```

```
14 HS = 1 - EK*(WS-WSE/E)  $  HS1 = -EK*(WS1-WSE1/E)
16 U = 1.0/HS  $  U1R = -U*HS1/HS
17 P = H*U  $  DXEDR = H*U1R + H1R*U
18 XE1 = H1X*U  $  XE2 = H2X*U  $  XEF = P - 1  $  RETURN
30 XEF = XE1 = XE2 = DXEDR = 0   $   RETURN   $   END
```

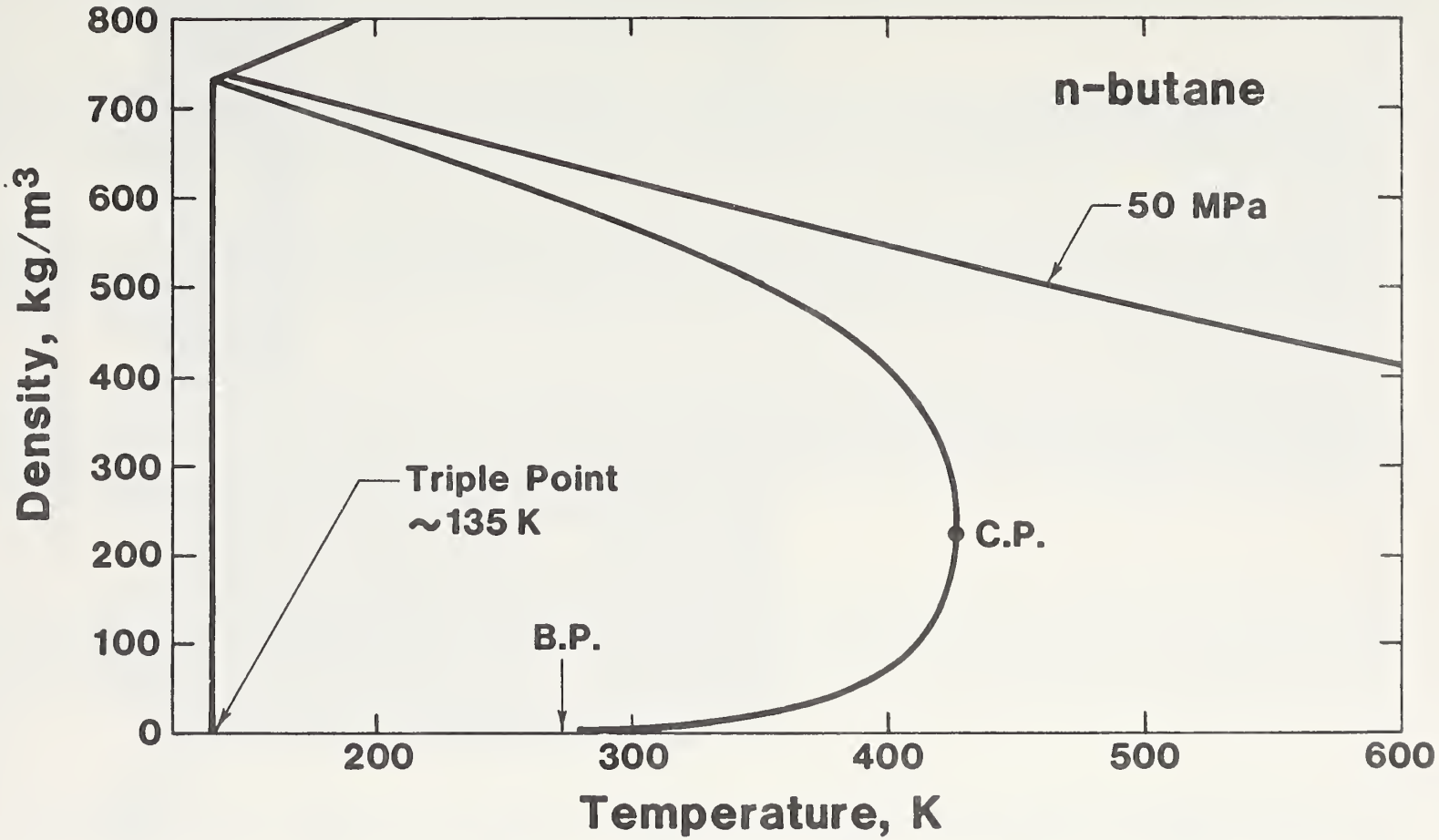

Figure 1. Density-temperature diagram of normal butane.

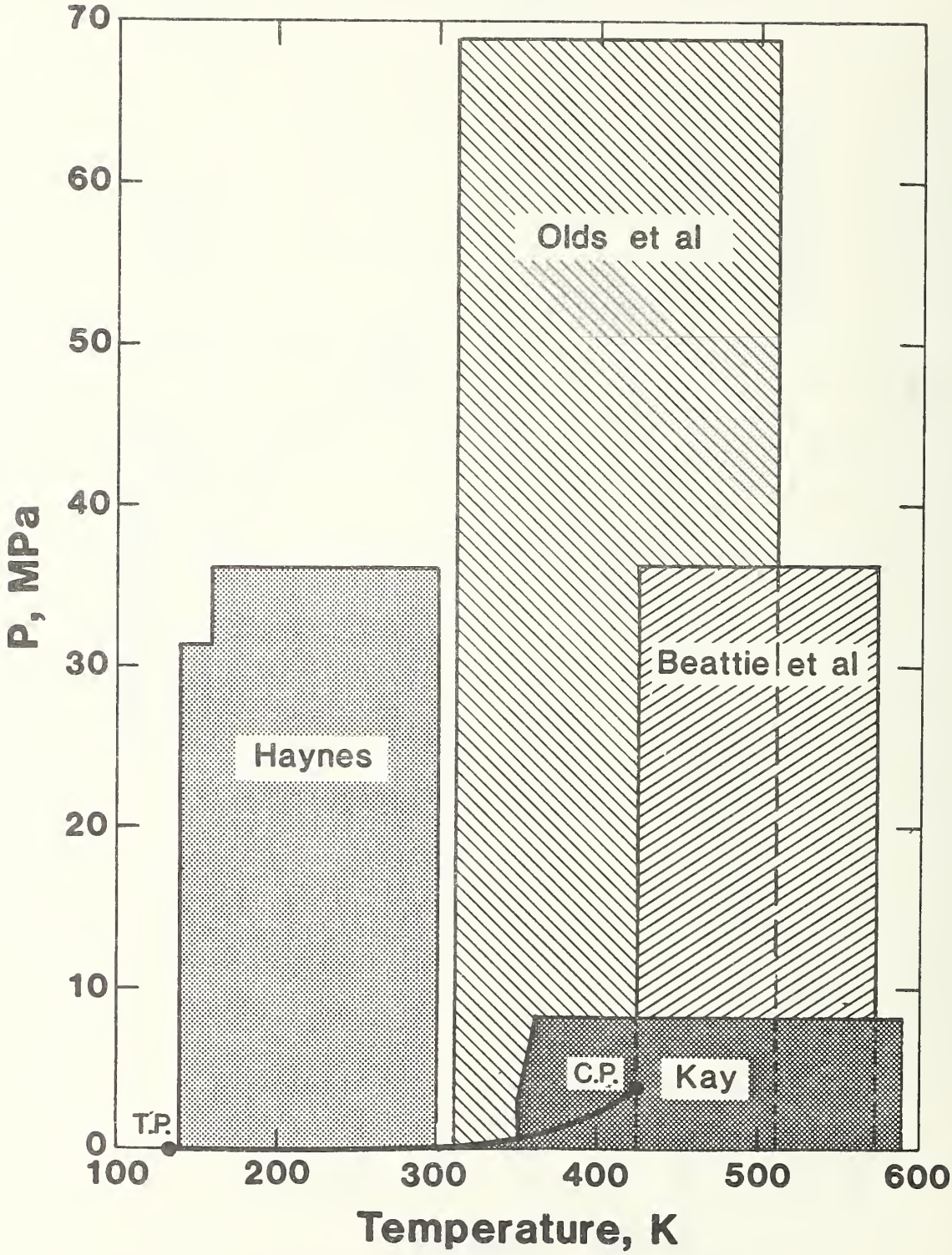

Figure 2. P-T locus of P-ρ-T data for normal butane.

Table 1. Comparisons of vapor pressure data with eq (2).

Data sources and ID numbers: (1)Aston, (2)Beattie, (10)Dana, (19)Kay, (29)Sage, (35)Wackher, (37)Connolly, (95)Seibert, (96)Carruth, (97)Hirata, (98)Tickner, (99)Delaplace, (40)Thermal Loops.

ID	Weight	Temp. K	T/T_c	P_σ(expt) MPa	P_σ(calc) MPa	Diff. %	dP_σ/dT MPa/K
40	1.000	134.860	.31720	.67437E-06	.67358E-06	.12	.128E-06
40	1.000	140.000	.32929	.17216E-05	.17210E-05	.03	.301E-06
40	1.000	145.000	.34105	.39908E-05	.39917E-05	-.02	.646E-06
40	1.000	150.000	.35281	.86893E-05	.86943E-05	-.06	.130E-05
40	1.000	155.000	.36457	.17884E-04	.17897E-04	-.07	.249E-05
40	1.000	160.000	.37633	.34986E-04	.35012E-04	-.07	.453E-05
40	1.000	165.000	.38809	.65366E-04	.65411E-04	-.07	.789E-05
40	1.000	170.000	.39985	.11714E-03	.11721E-03	-.05	.132E-04
40	1.000	175.000	.41161	.20212E-03	.20220E-03	-.04	.213E-04
40	1.000	180.000	.42337	.33690E-03	.33697E-03	-.02	.333E-04
40	1.000	185.000	.43513	.54411E-03	.54411E-03	-.00	.505E-04
40	1.000	190.000	.44689	.85368E-03	.85357E-03	.01	.745E-04
40	1.000	195.000	.45865	.13044E-02	.13040E-02	.03	.107E-03
1	1.000	195.107	.45890	.13200E-02	.13155E-02	.34	.108E-03
40	1.000	200.000	.47041	.19449E-02	.19442E-02	.04	.151E-03
40	1.000	205.000	.48217	.28356E-02	.28345E-02	.04	.208E-03
40	1.000	210.000	.49393	.40497E-02	.40479E-02	.04	.281E-03
1	1.000	212.668	.50021	.48340E-02	.48572E-02	-.48	.327E-03
40	1.000	215.000	.50569	.56740E-02	.56716E-02	.04	.372E-03
40	1.000	220.000	.51745	.78102E-02	.78075E-02	.03	.486E-03
40	1.000	225.000	.52921	.10576E-01	.10574E-01	.03	.625E-03
1	1.000	226.276	.53221	.11411E-01	.11396E-01	.13	.665E-03
40	1.000	230.000	.54097	.14106E-01	.14104E-01	.01	.792E-03
40	1.000	235.000	.55273	.18550E-01	.18550E-01	.00	.992E-03
1	1.000	235.822	.55467	.19409E-01	.19379E-01	.15	.103E-02
40	1.000	240.000	.56449	.24076E-01	.24079E-01	-.01	.123E-02
40	1.000	245.000	.57625	.30869E-01	.30877E-01	-.03	.150E-02
1	1.000	246.511	.57981	.33268E-01	.33211E-01	.17	.159E-02
40	1.000	250.000	.58801	.39131E-01	.39147E-01	-.04	.182E-02
40	1.000	255.000	.59977	.49080E-01	.49106E-01	-.05	.218E-02
1	1.000	256.204	.60261	.51832E-01	.51782E-01	.10	.227E-02
40	1.000	260.000	.61153	.60950E-01	.60989E-01	-.06	.259E-02
1	1.000	262.267	.61687	.67106E-01	.67078E-01	.04	.279E-02
40	1.000	265.000	.62329	.74991E-01	.75047E-01	-.07	.305E-02
1	1.000	266.789	.62750	.80656E-01	.80655E-01	.00	.322E-02
40	1.000	270.000	.63506	.91469E-01	.91543E-01	-.08	.356E-02
1	1.000	270.397	.63599	.92943E-01	.92966E-01	-.02	.360E-02
1	1.000	272.027	.63982	.98952E-01	.98989E-01	-.04	.379E-02
1	1.000	272.806	.64165	.10193E+00	.10197E+00	-.05	.388E-02
29	1.000	294.260	.69212	.21580E+00	.21562E+00	.08	.691E-02
29	1.000	327.590	.77051	.55660E+00	.55724E+00	-.11	.141E-01
97	1.000	333.130	.78354	.64017E+00	.63961E+00	.09	.156E-01
97	1.000	336.420	.79128	.69357E+00	.69259E+00	.14	.166E-01
19	1.000	336.480	.79142	.68950E+00	.69359E+00	-.59	.166E-01
97	1.000	340.940	.80191	.76916E+00	.77056E+00	-.18	.179E-01
97	1.000	343.070	.80692	.80878E+00	.80946E+00	-.08	.186E-01
29	1.000	344.260	.80972	.83420E+00	.83180E+00	.29	.190E-01
97	1.000	344.710	.81078	.83836E+00	.84037E+00	-.24	.191E-01
19	1.000	345.650	.81299	.86180E+00	.85848E+00	.39	.194E-01
2	1.000	348.140	.81884	.90790E+00	.90782E+00	.01	.202E-01
97	1.000	348.660	.82007	.91476E+00	.91838E+00	-.39	.204E-01
97	1.000	348.990	.82084	.92571E+00	.92513E+00	.06	.205E-01
97	1.000	352.640	.82943	.99917E+00	.10022E+01	-.30	.217E-01
19	1.000	353.870	.83232	.10342E+01	.10292E+01	.48	.222E-01
97	1.000	355.080	.83517	.10550E+01	.10563E+01	-.12	.226E-01
97	1.000	357.020	.83973	.10981E+01	.11008E+01	-.25	.233E-01
97	1.000	359.020	.84444	.11475E+01	.11481E+01	-.05	.240E-01
29	1.000	360.930	.84893	.12024E+01	.11946E+01	.65	.247E-01
97	1.000	361.140	.84942	.11995E+01	.11998E+01	-.03	.248E-01
19	1.000	361.210	.84959	.12066E+01	.12016E+01	.42	.248E-01
97	1.000	363.450	.85485	.12579E+01	.12581E+01	-.02	.257E-01
97	1.000	365.700	.86015	.13144E+01	.13169E+01	-.19	.266E-01
97	1.000	366.620	.86231	.13399E+01	.13415E+01	-.12	.269E-01
97	1.000	367.850	.86520	.13746E+01	.13749E+01	-.02	.274E-01
19	1.000	367.980	.86551	.13790E+01	.13785E+01	.04	.275E-01

Table 1. (Continued).

Data sources and ID numbers: (1)Aston, (2)Beattie, (10)Dana, (19)Kay, (29)Sage, (35)Wackher, (37)Connolly, (95)Seibert, (96)Carruth, (97)Hirata, (98)Tickner, (99)Delaplace, (40)Thermal Loops.

ID	Weight	Temp. K	T/T_c	P_σ(expt) MPa	P_σ(calc) MPa	Diff. %	dP_σ/dT MPa/K
97	1.000	369.620	.86937	.14225E+01	.14240E+01	-.11	.281E-01
2	1.000	373.140	.87765	.15290E+01	.15256E+01	.22	.296E-01
97	1.000	373.580	.87868	.15385E+01	.15386E+01	-.01	.298E-01
19	1.000	373.980	.87962	.15513E+01	.15506E+01	.05	.299E-01
97	1.000	375.040	.88211	.15785E+01	.15826E+01	-.25	.304E-01
97	1.000	377.240	.88729	.16505E+01	.16505E+01	-.00	.314E-01
19	1.000	379.430	.89244	.17237E+01	.17202E+01	.20	.323E-01
19	1.000	384.710	.90486	.18961E+01	.18974E+01	-.07	.348E-01
97	1.000	385.710	.90721	.19319E+01	.19324E+01	-.03	.353E-01
19	1.000	389.370	.91582	.20684E+01	.20648E+01	.17	.371E-01
97	1.000	391.010	.91968	.21239E+01	.21263E+01	-.12	.379E-01
97	1.000	396.090	.93163	.23251E+01	.23259E+01	-.03	.407E-01
2	1.000	398.140	.93645	.24207E+01	.24104E+01	.43	.418E-01
97	1.000	401.300	.94388	.25465E+01	.25455E+01	.04	.437E-01
2	1.000	423.140	.99525	.36730E+01	.36696E+01	.09	.612E-01
10	0.000	255.030	.59984	.49620E-01	.49171E-01	.91	.218E-02
10	0.000	260.490	.61269	.62230E-01	.62266E-01	-.06	.263E-02
10	0.000	271.350	.63823	.97540E-01	.96451E-01	1.13	.371E-02
10	0.000	272.960	.64202	.10172E+00	.10257E+00	-.83	.389E-02
10	0.000	272.960	.64202	.10230E+00	.10257E+00	-.26	.389E-02
10	0.000	283.420	.66662	.15040E+00	.15007E+00	.22	.523E-02
10	0.000	290.580	.68346	.19330E+00	.19130E+00	1.04	.631E-02
10	0.000	291.910	.68659	.19520E+00	.19984E+00	-2.32	.652E-02
10	0.000	298.690	.70254	.25000E+00	.24794E+00	.83	.769E-02
10	0.000	304.860	.71705	.30320E+00	.29894E+00	1.42	.886E-02
10	0.000	310.280	.72980	.35210E+00	.34996E+00	.61	.998E-02
10	0.000	314.420	.73953	.39690E+00	.39313E+00	.96	.109E-01
10	0.000	322.080	.75755	.48140E+00	.48338E+00	-.41	.127E-01
10	0.000	322.080	.75755	.48640E+00	.48338E+00	.62	.127E-01
10	0.000	322.150	.75771	.48930E+00	.48427E+00	1.04	.127E-01
10	0.000	330.100	.77641	.59080E+00	.59352E+00	-.46	.148E-01
10	0.000	330.100	.77641	.59770E+00	.59352E+00	.70	.148E-01
10	0.000	330.630	.77766	.60010E+00	.60140E+00	-.22	.149E-01
10	0.000	330.630	.77766	.60480E+00	.60140E+00	.57	.149E-01
19	0.000	325.040	.76451	.51710E+00	.52209E+00	-.96	.135E-01
29	0.000	310.930	.73132	.35180E+00	.35649E+00	-1.31	.101E-01
35	0.000	205.450	.48323	.31300E-02	.29293E-02	6.85	.214E-03
35	0.000	213.150	.50134	.56700E-02	.50169E-02	13.02	.336E-03
35	0.000	228.150	.53662	.13280E-01	.12699E-01	4.57	.727E-03
35	0.000	241.850	.56884	.27650E-01	.26436E-01	4.59	.132E-02
35	0.000	250.450	.58907	.41450E-01	.39970E-01	3.70	.185E-02
35	0.000	255.450	.60083	.51260E-01	.50093E-01	2.33	.221E-02
35	0.000	261.850	.61589	.66390E-01	.65923E-01	.71	.275E-02
35	0.000	266.050	.62576	.78570E-01	.78300E-01	.35	.315E-02
35	0.000	273.150	.64246	.10338E+00	.10331E+00	.06	.392E-02
35	0.000	278.750	.65564	.12732E+00	.12713E+00	.15	.460E-02
37	0.000	344.260	.80972	.83086E+00	.83180E+00	-.11	.190E-01
37	0.000	360.930	.84893	.11946E+01	.11946E+01	-.00	.247E-01
37	0.000	377.590	.88811	.16638E+01	.16615E+01	.14	.315E-01
37	0.000	394.260	.92732	.22575E+01	.22524E+01	.23	.397E-01
37	0.000	406.870	.95698	.28037E+01	.27985E+01	.18	.472E-01
37	0.000	410.930	.96653	.30013E+01	.29959E+01	.18	.501E-01
37	0.000	425.120	.99991	.37845E+01	.37934E+01	-.24	.642E-01
95	0.000	303.150	.71303	.34000E+00	.28408E+00	19.68	.853E-02
95	0.000	313.150	.73655	.44660E+00	.37949E+00	17.69	.106E-01
95	0.000	323.150	.76007	.57330E+00	.49712E+00	15.33	.130E-01
95	0.000	333.150	.78359	.71990E+00	.63992E+00	12.50	.156E-01
95	0.000	343.150	.80711	.89330E+00	.81095E+00	10.16	.186E-01
95	0.000	363.150	.85415	.14265E+01	.12505E+01	14.08	.256E-01
95	0.000	373.150	.87767	.16665E+01	.15259E+01	9.22	.296E-01
95	0.000	383.150	.90119	.19598E+01	.18437E+01	6.30	.341E-01
95	0.000	393.150	.92471	.24131E+01	.22087E+01	9.25	.391E-01
95	0.000	403.150	.94823	.27464E+01	.26274E+01	4.53	.448E-01
96	0.000	135.430	.31854	.90230E-06	.75036E-06	20.25	.141E-06

Table 1. (Continued).

Data sources and ID numbers: (1)Aston, (2)Beattie, (10)Dana, (19)Kay, (29)Sage, (35)Wackher, (37)Connolly, (95)Seibert, (96)Carruth, (97)Hirata, (98)Tickner, (99)Delaplace, (40)Thermal Loops.

ID	Weight	Temp. K	T/T_c	P_σ(expt) MPa	P_σ(calc) MPa	Diff. %	dP_σ/dT MPa/K
96	0.000	137.730	.32395	.10800E-05	.11483E-05	-5.95	.208E-06
96	0.000	138.930	.32677	.14490E-05	.14248E-05	1.70	.254E-06
96	0.000	146.320	.34415	.51320E-05	.49311E-05	4.08	.781E-06
96	0.000	148.100	.34834	.67810E-05	.65132E-05	4.11	.100E-05
96	0.000	154.840	.36419	.18450E-04	.17503E-04	5.41	.244E-05
96	0.000	159.790	.37583	.32260E-04	.34071E-04	-5.32	.442E-05
96	0.000	171.430	.40321	.12590E-03	.13750E-03	-8.44	.152E-04
96	0.000	184.090	.43299	.48660E-03	.49978E-03	-2.64	.469E-04
96	0.000	194.650	.45783	.12420E-02	.12669E-02	-1.97	.105E-03
96	0.000	196.710	.46267	.15390E-02	.14988E-02	2.68	.121E-03
96	0.000	205.270	.48281	.31320E-02	.28910E-02	8.33	.211E-03
96	0.000	209.280	.49224	.37740E-02	.38501E-02	-1.98	.269E-03
96	0.000	212.900	.50075	.49480E-02	.49335E-02	.29	.331E-03
98	0.000	135.850	.31953	.66660E-06	.81196E-06	-17.90	.152E-06
98	0.000	139.950	.32917	.13330E-05	.17060E-05	-21.86	.299E-06
98	0.000	144.250	.33928	.26660E-05	.35332E-05	-24.54	.578E-06
98	0.000	149.950	.35269	.66660E-05	.86294E-05	-22.75	.129E-05
98	0.000	154.750	.36398	.13330E-04	.17284E-04	-22.88	.241E-05
98	0.000	159.850	.37598	.26660E-04	.34338E-04	-22.36	.445E-05
98	0.000	166.950	.39268	.66660E-04	.82509E-04	-19.21	.969E-05
98	0.000	172.850	.40655	.13330E-03	.16065E-03	-17.02	.174E-04
98	0.000	179.250	.42161	.26660E-03	.31277E-03	-14.76	.312E-04
98	0.000	188.450	.44324	.66660E-03	.74455E-03	-10.47	.663E-04
98	0.000	195.850	.46065	.13330E-02	.13979E-02	-4.64	.114E-03
99	0.000	135.150	.31788	.17330E-05	.71170E-06	143.50	.135E-06
99	0.000	136.150	.32023	.20000E-05	.85875E-06	132.90	.160E-06
99	0.000	137.150	.32258	.22660E-05	.10330E-05	119.36	.189E-06
99	0.000	138.150	.32494	.25730E-05	.12390E-05	107.67	.223E-06
99	0.000	139.150	.32729	.30000E-05	.14816E-05	102.48	.263E-06
99	0.000	140.150	.32964	.39060E-05	.17667E-05	121.09	.308E-06
99	0.000	142.150	.33434	.45330E-05	.24913E-05	81.95	.421E-06
99	0.000	143.150	.33670	.53330E-05	.29465E-05	80.99	.491E-06
99	0.000	144.150	.33905	.62000E-05	.34758E-05	78.38	.570E-06
99	0.000	145.150	.34140	.72000E-05	.40896E-05	76.06	.660E-06
99	0.000	146.150	.34375	.83330E-05	.47998E-05	73.61	.763E-06
99	0.000	147.150	.34610	.96790E-05	.56196E-05	72.24	.879E-06
99	0.000	148.150	.34846	.11332E-04	.65636E-05	72.65	.101E-05
99	0.000	149.150	.35081	.14000E-04	.76483E-05	83.05	.116E-05
99	0.000	150.150	.35316	.17065E-04	.88917E-05	91.92	.133E-05
99	0.000	151.150	.35551	.19865E-04	.10314E-04	92.60	.152E-05

Number of data points used in fit = 80; rms pressure deviation = 0.189%.

Table 2. Comparisons of saturated liquid density data with eq (3).

Data sources and ID numbers: (2)Carney, (7)Coffin, (8)Connolly, (10)Dana, (15)Foehr, (17)Benoliel, (18)Kahre, (19)Kay, (25)Olds, (29)Sage, (32)Sliwinski, (33)NGAA, (90)Haynes, (91)Orrit, (92)McClune, (93)Van der Vet.

ID	Weight	Temp. K	$(T_c-T)/(T_c-T_t)$	Density (expt) mol/L	Density (expt) kg/m3	Density (calc) kg/m3	Diff. %	$d\rho_\ell/dT$ kg/(m3•K)
90	1.000	135.075	.99926	12.652	735.37	735.07	.04	-.9441
91	1.000	138.041	.98904	12.595	732.08	732.27	-.03	-.9430
90	1.000	140.075	.98204	12.571	730.66	730.35	.04	-.9423
91	1.000	142.049	.97524	12.532	728.42	728.49	-.01	-.9418
92	1.000	143.150	.97144	12.514	727.36	727.46	-.01	-.9415
90	1.000	145.075	.96481	12.492	726.09	725.65	.06	-.9410
91	1.000	147.788	.95547	12.441	723.11	723.09	.00	-.9404
92	1.000	148.150	.95422	12.435	722.76	722.75	.00	-.9404
90	1.000	150.075	.94759	12.409	721.28	720.94	.05	-.9401
92	1.000	153.150	.93700	12.357	718.22	718.05	.02	-.9397
91	1.000	153.204	.93681	12.354	718.04	718.00	.01	-.9397
90	1.000	155.075	.93037	12.330	716.67	716.24	.06	-.9395
92	1.000	158.150	.91977	12.276	713.53	713.36	.02	-.9394
91	1.000	158.587	.91827	12.266	712.94	712.94	-.00	-.9394
90	1.000	160.075	.91314	12.248	711.93	711.55	.05	-.9394
92	1.000	163.150	.90255	12.196	708.87	708.66	.03	-.9395
91	1.000	164.010	.89959	12.179	707.91	707.85	.01	-.9395
90	1.000	165.075	.89592	12.163	706.99	706.85	.02	-.9396
92	1.000	168.150	.88533	12.116	704.26	703.96	.04	-.9400
91	1.000	169.522	.88060	12.092	702.81	702.67	.02	-.9402
90	1.000	170.075	.87869	12.084	702.37	702.15	.03	-.9403
92	1.000	173.150	.86810	12.035	699.55	699.26	.04	-.9409
91	1.000	174.926	.86198	12.003	697.69	697.59	.01	-.9414
91	1.000	180.442	.84298	11.915	692.52	692.39	.02	-.9431
91	1.000	186.368	.82257	11.817	686.88	686.79	.01	-.9456
91	1.000	191.789	.80390	11.728	681.66	681.66	-.00	-.9484
91	1.000	197.248	.78509	11.636	676.35	676.47	-.02	-.9519
91	1.000	204.288	.76084	11.522	669.68	669.75	-.01	-.9572
91	1.000	208.227	.74727	11.458	665.96	665.98	-.00	-.9606
91	1.000	213.846	.72792	11.362	660.42	660.56	-.02	-.9661
91	1.000	219.353	.70895	11.271	655.14	655.23	-.01	-.9722
91	1.000	224.970	.68960	11.174	649.46	649.75	-.04	-.9791
33	1.000	226.820	.68322	11.143	647.70	647.93	-.04	-.9816
90	1.000	230.000	.67227	11.091	644.66	644.80	-.02	-.9860
91	1.000	233.391	.66059	11.034	641.35	641.45	-.02	-.9910
33	1.000	235.870	.65205	10.992	638.90	638.99	-.01	-.9948
33	1.000	238.650	.64247	10.942	636.00	636.22	-.03	-.9993
91	1.000	241.557	.63246	10.892	633.07	633.31	-.04	-1.0043
91	1.000	247.215	.61297	10.793	627.35	627.60	-.04	-1.0146
33	1.000	247.760	.61109	10.791	627.20	627.04	.03	-1.0157
91	1.000	252.249	.59563	10.702	622.06	622.46	-.07	-1.0246
33	1.000	255.370	.58488	10.662	619.70	619.26	.07	-1.0312
33	1.000	255.430	.58467	10.658	619.50	619.19	.05	-1.0314
91	1.000	258.254	.57494	10.597	615.95	616.27	-.05	-1.0377
91	1.000	263.785	.55589	10.496	610.09	610.50	-.07	-1.0508
33	1.000	266.480	.54661	10.464	608.20	607.66	.09	-1.0576
91	1.000	269.401	.53654	10.393	604.11	604.56	-.07	-1.0652
91	1.000	274.973	.51735	10.289	598.05	598.58	-.09	-1.0808
33	1.000	277.150	.50985	10.259	596.30	596.22	.01	-1.0873
32	1.000	283.200	.48901	10.145	589.67	589.58	.01	-1.1064
90	1.000	288.706	.47004	10.033	583.13	583.44	-.05	-1.1253
33	1.000	288.710	.47003	10.047	584.00	583.44	.10	-1.1253
90	1.000	290.000	.46559	10.007	581.63	581.98	-.06	-1.1299
32	1.000	293.190	.45460	9.949	578.28	578.36	-.01	-1.1418
33	1.000	299.820	.43176	9.822	570.90	570.70	.04	-1.1685
90	1.000	300.000	.43114	9.810	570.22	570.49	-.05	-1.1693
32	1.000	303.150	.42029	9.752	566.82	566.79	.01	-1.1829
33	1.000	310.930	.39349	9.597	557.80	557.44	.06	-1.2197
25	1.000	310.930	.39349	9.586	557.16	557.44	-.05	-1.2197
32	1.000	313.120	.38595	9.545	554.78	554.76	.00	-1.2309
33	1.000	322.040	.35522	9.363	544.20	543.56	.12	-1.2809
32	1.000	323.120	.35150	9.327	542.13	542.17	-.01	-1.2875
32	1.000	333.110	.31709	9.102	529.06	528.99	.01	-1.3547

Table 2. (Continued).

Data sources and ID numbers: (2)Carney, (7)Coffin, (8)Connolly, (10)Dana, (15)Foehr, (17)Benoliel, (18)Kahre, (19)Kay, (25)Olds, (29)Sage, (32)Sliwinski, (33)NGAA, (90)Haynes, (91)Orrit, (92)McClune, (93)Van der Vet.

ID	Weight	Temp. K	$(T_c-T)/(T_c-T_t)$	Density (expt) mol/L	Density (expt) kg/m3	Density (calc) kg/m3	Diff. %	$d\rho_\ell/dT$ kg/(m3·K)
33	1.000	333.150	.31695	9.108	529.40	528.93	.09	-1.3550
32	1.000	343.080	.28274	8.863	515.18	515.09	.02	-1.4354
25	1.000	344.260	.27868	8.833	513.41	513.39	.00	-1.4460
32	1.000	353.090	.24826	8.606	500.24	500.24	-.00	-1.5348
32	1.000	363.110	.21374	8.330	484.20	484.26	-.01	-1.6603
32	1.000	368.100	.19656	8.186	475.82	475.79	.01	-1.7360
25	1.000	377.590	.16386	7.899	459.11	458.51	.13	-1.9148
25	1.000	410.930	.04902	6.405	372.26	373.21	-.25	-3.8043
2	0.000	227.594	.68056	11.131	647.00	647.17	-.03	-.9826
2	0.000	233.150	.66142	11.038	641.60	641.69	-.01	-.9906
2	0.000	238.706	.64228	10.944	636.10	636.16	-.01	-.9994
2	0.000	244.261	.62315	10.849	630.60	630.59	.00	-1.0091
2	0.000	249.817	.60401	10.755	625.10	624.95	.02	-1.0197
2	0.000	255.372	.58487	10.662	619.70	619.25	.07	-1.0313
2	0.000	266.483	.54660	10.464	608.20	607.65	.09	-1.0576
2	0.000	277.150	.50985	10.259	596.30	596.22	.01	-1.0873
2	0.000	288.706	.47004	10.047	584.00	583.44	.10	-1.1253
2	0.000	310.928	.39350	9.597	557.80	557.45	.06	-1.2197
2	0.000	322.039	.35522	9.363	544.20	543.56	.12	-1.2809
2	0.000	333.150	.31695	9.108	529.40	528.93	.09	-1.3550
7	0.000	238.750	.64213	10.946	636.20	636.12	.01	-.9995
7	0.000	240.350	.63662	10.918	634.60	634.52	.01	-1.0022
7	0.000	242.950	.62766	10.870	631.80	631.91	-.02	-1.0067
7	0.000	248.550	.60837	10.779	626.50	626.24	.04	-1.0172
7	0.000	254.150	.58908	10.679	620.70	620.51	.03	-1.0286
7	0.000	258.750	.57323	10.596	615.90	615.76	.02	-1.0388
7	0.000	262.650	.55980	10.531	612.10	611.69	.07	-1.0480
7	0.000	266.450	.54671	10.462	608.10	607.69	.07	-1.0575
7	0.000	269.650	.53569	10.405	604.80	604.29	.08	-1.0659
7	0.000	272.350	.52639	10.357	602.00	601.40	.10	-1.0733
7	0.000	274.450	.51915	10.319	599.80	599.14	.11	-1.0793
7	0.000	281.650	.49435	10.199	592.80	591.29	.25	-1.1013
7	0.000	286.850	.47644	10.090	586.50	585.52	.17	-1.1187
7	0.000	288.650	.47024	10.054	584.40	583.50	.15	-1.1251
7	0.000	291.950	.45887	9.987	580.50	579.77	.13	-1.1371
7	0.000	296.450	.44337	9.905	575.70	574.62	.19	-1.1546
7	0.000	299.650	.43235	9.832	571.50	570.90	.11	-1.1678
7	0.000	302.450	.42270	9.774	568.10	567.61	.09	-1.1798
7	0.000	305.650	.41168	9.710	564.40	563.81	.10	-1.1943
8	0.000	293.150	.45474	9.960	578.90	578.40	.09	-1.1417
8	0.000	298.150	.43751	9.862	573.20	572.65	.10	-1.1615
10	0.000	273.150	.52363	10.309	599.20	600.54	-.22	-1.0756
10	0.000	281.150	.49607	10.163	590.70	591.84	-.19	-1.0997
10	0.000	289.150	.46852	10.013	582.00	582.94	-.16	-1.1269
10	0.000	297.150	.44096	9.850	572.50	573.81	-.23	-1.1574
10	0.000	305.150	.41340	9.695	563.50	564.41	-.16	-1.1920
10	0.000	313.150	.38584	9.528	553.80	554.72	-.17	-1.2311
10	0.000	321.150	.35828	9.352	543.60	544.70	-.20	-1.2756
10	0.000	329.150	.33073	9.161	532.50	534.30	-.34	-1.3266
15	0.000	293.150	.45474	9.963	579.10	578.40	.12	-1.1417
17	0.000	213.150	.73031	11.383	661.60	661.24	.06	-.9654
17	0.000	223.150	.69587	11.216	651.90	651.53	.06	-.9768
17	0.000	233.150	.66142	11.047	642.10	641.69	.06	-.9906
17	0.000	243.150	.62697	10.875	632.10	631.71	.06	-1.0071
17	0.000	253.150	.59252	10.701	622.00	621.54	.07	-1.0265
17	0.000	263.150	.55808	10.519	611.40	611.16	.04	-1.0492
17	0.000	273.150	.52363	10.337	600.80	600.54	.04	-1.0756
17	0.000	283.150	.48918	10.147	589.80	589.64	.03	-1.1062
17	0.000	293.150	.45474	9.956	578.70	578.40	.05	-1.1417
18	0.000	288.750	.46989	10.054	584.40	583.39	.17	-1.1254
18	0.000	327.550	.33624	9.238	536.95	536.41	.10	-1.3158
19	0.000	325.040	.34488	9.309	541.10	539.69	.26	-1.2995

Table 2. (Continued).

Data sources and ID numbers: (2)Carney, (7)Coffin, (8)Connolly, (10)Dana, (15)Foehr, (17)Benoliel, (18)Kahre, (19)Kay, (25)Olds, (29)Sage, (32)Sliwinski, (33)NGAA, (90)Haynes, (91)Orrit, (92)McClune, (93)Van der Vet.

ID	Weight	Temp. K	$(T_c-T)/(T_c-T_t)$	Density (expt) mol/L	Density (expt) kg/m^3	Density (calc) kg/m^3	Diff. %	$d\rho_\ell/dT$ kg/(m^3•K)
19	0.000	336.480	.30548	9.045	525.73	524.38	.26	-1.3802
19	0.000	345.650	.27389	8.827	513.07	511.37	.33	-1.4589
19	0.000	353.870	.24557	8.618	500.90	499.04	.37	-1.5436
19	0.000	361.310	.21994	8.414	489.05	487.23	.37	-1.6354
19	0.000	367.980	.19697	8.215	477.51	476.00	.32	-1.7341
19	0.000	373.980	.17630	8.031	466.78	465.29	.32	-1.8404
19	0.000	379.430	.15753	7.854	456.53	454.95	.35	-1.9564
19	0.000	384.710	.13934	7.670	445.80	444.27	.34	-2.0925
19	0.000	389.370	.12329	7.493	435.54	434.19	.31	-2.2392
19	0.000	393.760	.10816	7.314	425.13	424.00	.27	-2.4093
19	0.000	402.040	.07964	6.931	402.87	402.32	.14	-2.8669
19	0.000	405.870	.06645	6.730	391.17	390.76	.10	-3.1830
19	0.000	409.320	.05456	6.529	379.48	379.15	.09	-3.5714
19	0.000	412.870	.04234	6.292	365.70	365.51	.05	-4.1501
19	0.000	415.980	.03162	6.046	351.44	351.47	-.01	-4.9439
19	0.000	419.260	.02032	5.743	333.83	333.05	.23	-6.4725
19	0.000	422.320	.00978	5.330	309.80	308.68	.36	-10.1943
29	0.000	294.260	.45091	10.007	581.64	577.13	.78	-1.1460
29	0.000	310.930	.39349	9.650	560.87	557.44	.61	-1.2197
29	0.000	327.590	.33610	9.301	540.61	536.36	.79	-1.3161
29	0.000	344.260	.27868	8.919	518.40	513.39	.98	-1.4460
29	0.000	360.930	.22125	8.449	491.06	487.85	.66	-1.6303
29	0.000	377.590	.16386	7.928	460.83	458.51	.51	-1.9148
29	0.000	394.260	.10644	7.258	421.87	422.79	-.22	-2.4311
91	0.000	135.366	.99826	12.640	734.70	734.79	-.01	-.9439
91	0.000	139.441	.98422	12.574	730.88	730.95	-.01	-.9425
91	0.000	144.783	.96582	12.489	725.91	725.92	-.00	-.9411
91	0.000	150.530	.94602	12.397	720.55	720.52	.00	-.9400
91	0.000	155.930	.92742	12.310	715.48	715.44	.01	-.9395
91	0.000	161.370	.90868	12.221	710.35	710.33	.00	-.9394
91	0.000	166.654	.89048	12.138	705.49	705.37	.02	-.9398
91	0.000	172.198	.87138	12.047	700.24	700.15	.01	-.9407
91	0.000	177.707	.85240	11.959	695.10	694.97	.02	-.9422
91	0.000	183.502	.83244	11.864	689.57	689.50	.01	-.9443
91	0.000	189.090	.81319	11.772	684.23	684.22	.00	-.9470
91	0.000	194.492	.79458	11.683	679.09	679.09	-.00	-.9501
91	0.000	202.744	.76616	11.544	670.99	671.23	-.04	-.9559
91	0.000	205.434	.75689	11.503	668.61	668.66	-.01	-.9582
91	0.000	211.023	.73764	11.411	663.23	663.29	-.01	-.9633
91	0.000	216.623	.71835	11.318	657.86	657.88	-.00	-.9691
91	0.000	222.085	.69953	11.226	652.52	652.57	-.01	-.9755
91	0.000	230.623	.67012	11.083	644.16	644.19	-.00	-.9869
91	0.000	236.111	.65122	10.988	638.64	638.75	-.02	-.9952
91	0.000	244.335	.62289	10.844	630.28	630.51	-.04	-1.0092
91	0.000	249.972	.60347	10.744	624.47	624.79	-.05	-1.0200
91	0.000	255.364	.58490	10.649	618.94	619.26	-.05	-1.0312
91	0.000	261.019	.56542	10.547	613.04	613.40	-.06	-1.0441
91	0.000	266.732	.54574	10.443	607.00	607.39	-.06	-1.0582
91	0.000	273.038	.52402	10.326	600.18	600.66	-.08	-1.0753
93	0.000	283.150	.48918	10.130	588.80	589.64	-.14	-1.1062
93	0.000	288.710	.47003	10.023	582.60	583.44	-.14	-1.1253
93	0.000	293.150	.45474	9.944	578.00	578.40	-.07	-1.1417
93	0.000	298.150	.43751	9.846	572.30	572.65	-.06	-1.1615
93	0.000	303.150	.42029	9.746	566.50	566.79	-.05	-1.1829
93	0.000	308.150	.40307	9.641	560.40	560.81	-.07	-1.2061
93	0.000	313.150	.38584	9.538	554.40	554.72	-.06	-1.2311
93	0.000	318.150	.36862	9.435	548.40	548.50	-.02	-1.2582
93	0.000	323.150	.35140	9.328	542.20	542.14	.01	-1.2877

Number of data points used in fit = 71; rms density deviation = 0.054%.

Table 3. Comparisons of saturated vapor density data with eq (4).

Data sources and ID numbers: (10)Dana, (19)Kay, (25)Olds, (29)Sage, (32)Sliwinski, (40)Virial/vapor pressure equations.

ID	Weight	Temp. K	Density (expt) mol/L	Density (expt) kg/m3	Density (calc) kg/m3	Diff. %	Z(expt)	Z(calc)	F(Z) [1]	$d\rho_v/dT$ kg/(m3·K)
40	0.000	135.000	.000	.35821E-04	.35821E-04	.00	1.00000	1.00000	2.81289	.654E-05
40	0.000	140.000	.000	.85937E-04	.85937E-04	.00	.99999	.99999	2.63640	.144E-04
40	1.000	145.000	.000	.19245E-03	.19245E-03	.00	.99998	.99998	2.47768	.298E-04
40	1.000	150.000	.000	.40521E-03	.40521E-03	.00	.99997	.99997	2.33440	.580E-04
40	1.000	155.000	.000	.80723E-03	.80723E-03	.00	.99994	.99994	2.20460	.107E-03
40	1.000	160.000	.000	.15299E-02	.15299E-02	-.00	.99990	.99990	2.08654	.189E-03
40	1.000	165.000	.000	.27718E-02	.27718E-02	-.00	.99984	.99983	1.97908	.318E-03
40	1.000	170.000	.000	.48211E-02	.48211E-02	-.00	.99974	.99973	1.88123	.515E-03
40	1.000	175.000	.000	.80806E-02	.80807E-02	-.00	.99959	.99958	1.79129	.807E-03
40	1.000	180.000	.000	.13095E-01	.13095E-01	-.00	.99939	.99937	1.70871	.122E-02
40	1.000	185.000	.000	.20579E-01	.20580E-01	-.00	.99910	.99907	1.63272	.180E-02
40	1.000	190.000	.001	.31446E-01	.31447E-01	-.00	.99872	.99868	1.56267	.258E-02
40	1.000	195.000	.001	.46831E-01	.46834E-01	-.01	.99822	.99816	1.49799	.362E-02
40	1.000	200.000	.001	.68121E-01	.68126E-01	-.01	.99758	.99751	1.43818	.495E-02
40	1.000	205.000	.002	.96972E-01	.96980E-01	-.01	.99678	.99669	1.38280	.665E-02
40	1.000	210.000	.002	.13532E+00	.13534E+00	-.01	.99577	.99568	1.33146	.877E-02
40	1.000	215.000	.003	.18542E+00	.18544E+00	-.01	.99455	.99447	1.28383	.114E-01
40	1.000	220.000	.004	.24982E+00	.24984E+00	-.01	.99309	.99302	1.23961	.145E-01
40	1.000	225.000	.006	.33139E+00	.33139E+00	-.00	.99135	.99133	1.19852	.182E-01
40	1.000	230.000	.007	.43331E+00	.43328E+00	.01	.98930	.98937	1.16032	.226E-01
40	1.000	235.000	.010	.55911E+00	.55901E+00	.02	.98694	.98712	1.12481	.278E-01
40	1.000	240.000	.012	.71262E+00	.71237E+00	.03	.98422	.98456	1.09179	.337E-01
40	1.000	245.000	.015	.89798E+00	.89748E+00	.06	.98113	.98168	1.06108	.405E-01
40	1.000	250.000	.019	.11197E+01	.11188E+01	.08	.97764	.97845	1.03253	.482E-01
40	1.000	255.000	.024	.13825E+01	.13809E+01	.12	.97373	.97486	1.00600	.569E-01
40	1.000	260.000	.029	.16916E+01	.16890E+01	.15	.96939	.97089	.98137	.666E-01
40	1.000	265.000	.035	.20524E+01	.20483E+01	.20	.96458	.96651	.95851	.774E-01
40	1.000	270.000	.043	.24707E+01	.24646E+01	.25	.95930	.96170	.93733	.893E-01
32	1.000	293.190	.092	.53474E+01	.53237E+01	.45	.92887	.93301	.84893	.162E+00
32	1.000	303.150	.123	.71609E+01	.71438E+01	.24	.91482	.91701	.79702	.204E+00
25	1.000	310.930	.153	.88814E+01	.88781E+01	.04	.90245	.90278	.76518	.242E+00
32	1.000	313.120	.162	.93929E+01	.94216E+01	-.31	.90124	.89849	.73859	.254E+00
32	1.000	323.120	.210	.12200E+02	.12250E+02	-.41	.88086	.87727	.72430	.313E+00
19	1.000	325.040	.221	.12816E+02	.12864E+02	-.37	.87611	.87288	.72510	.326E+00
32	1.000	333.110	.269	.15653E+02	.15723E+02	-.44	.85712	.85331	.71728	.384E+00
32	1.000	343.080	.342	.19861E+02	.19959E+02	-.49	.83065	.82656	.71209	.469E+00
25	1.000	344.260	.352	.20442E+02	.20519E+02	-.37	.82628	.82320	.71590	.480E+00
32	1.000	353.090	.431	.25069E+02	.25150E+02	-.32	.79927	.79670	.71521	.572E+00
19	1.000	361.210	.518	.30114E+02	.30197E+02	-.27	.77223	.77011	.71534	.674E+00
32	1.000	363.110	.543	.31538E+02	.31504E+02	.11	.76271	.76355	.72424	.701E+00

[1] See section 2.3(b) for definition of F(Z).

Table 3. (Continued).

Data sources and ID numbers: (10)Dana, (19)Kay, (25)Olds, (29)Sage, (32)Sliwinski, (40)Virial/vapor pressure equations.

ID	Weight	Temp. K	Density (expt) mol/L	Density (expt) kg/m3	Density (calc) kg/m3	Diff. %	Z(expt)	Z(calc)	F(Z)	$d\rho_v/dT$ kg/(m3•K)
19	1.000	367.980	.601	.34921E+02	.35098E+02	-.50	.74991	.74613	.71056	.777E+00
32	1.000	368.100	.607	.35252E+02	.35191E+02	.17	.74439	.74569	.72496	.779E+00
25	1.000	377.590	.742	.43105E+02	.43399E+02	-.68	.71363	.70879	.71075	.960E+00
19	1.000	384.710	.874	.50777E+02	.50844E+02	-.13	.67900	.67812	.72420	.114E+01
19	1.000	389.370	.970	.56386E+02	.56484E+02	-.17	.65746	.65632	.72745	.129E+01
19	1.000	393.760	1.075	.62472E+02	.62495E+02	-.04	.63449	.63426	.73416	.146E+01
19	1.000	398.150	1.193	.69360E+02	.69346E+02	.02	.61029	.61041	.74115	.167E+01
19	1.000	402.040	1.317	.76567E+02	.76309E+02	.34	.58545	.58743	.75176	.192E+01
19	1.000	405.870	1.452	.84420E+02	.84232E+02	.22	.56141	.56266	.75945	.224E+01
19	1.000	409.320	1.596	.92749E+02	.92581E+02	.18	.53700	.53797	.76937	.263E+01
25	1.000	410.930	1.669	.97021E+02	.96991E+02	.03	.52531	.52547	.77387	.286E+01
19	1.000	412.870	1.772	.10300E+03	.10286E+03	.13	.50871	.50939	.78277	.320E+01
19	1.000	415.980	1.959	.11389E+03	.11395E+03	-.06	.48083	.48056	.79741	.399E+01
19	1.000	419.260	2.216	.12879E+03	.12921E+03	-.33	.44545	.44398	.81945	.549E+01
19	1.000	422.320	2.585	.15025E+03	.15040E+03	-.10	.39879	.39840	.85679	.905E+01
10	0.000	281.150	.065	.37897E+01	.36290E+01	4.43	.90903	.94930	1.50115	.121E+00
10	0.000	289.150	.084	.48999E+01	.46983E+01	4.29	.90022	.93883	1.32258	.147E+00
10	0.000	297.150	.104	.60507E+01	.59977E+01	.88	.91881	.92693	.87740	.178E+00
10	0.000	305.150	.130	.75620E+01	.75617E+01	.00	.91346	.91350	.77298	.214E+00
10	0.000	313.150	.163	.94801E+01	.94293E+01	.54	.89362	.89843	.79510	.254E+00
10	0.000	321.150	.207	.12003E+02	.11645E+02	3.07	.85541	.88167	.91443	.301E+00
19	0.000	336.480	.284	.16501E+02	.17061E+02	-3.28	.87325	.84459	.59843	.411E+00
19	0.000	345.650	.358	.20826E+02	.21195E+02	-1.74	.83370	.81918	.66940	.493E+00
19	0.000	353.870	.435	.25307E+02	.25600E+02	-1.14	.80342	.79424	.69179	.581E+00
19	0.000	373.980	.681	.39565E+02	.40072E+02	-1.27	.73258	.72332	.69765	.885E+00
19	0.000	379.430	.772	.44855E+02	.45203E+02	-.77	.70659	.70114	.71022	.100E+01
29	0.000	294.260	.095	.55102E+01	.54997E+01	.19	.92963	.93140	.81734	.167E+00
29	0.000	310.930	.153	.88994E+01	.88781E+01	.24	.90062	.90278	.77951	.242E+00
29	0.000	327.590	.237	.13787E+02	.13717E+02	.51	.86250	.86690	.76591	.343E+00
29	0.000	344.260	.356	.20681E+02	.20519E+02	.79	.81676	.82320	.75514	.480E+00
29	0.000	360.930	.522	.30364E+02	.30009E+02	1.18	.76204	.77106	.75051	.670E+00
29	0.000	377.590	.765	.44448E+02	.43399E+02	2.42	.69207	.70879	.76426	.960E+00
29	0.000	394.260	1.140	.66273E+02	.63229E+02	4.81	.60263	.63164	.79317	.148E+01
32	0.000	283.200	.069	.39990E+01	.38828E+01	2.99	.91925	.94674	1.25777	.127E+00

Number of data points used in fit = 53; rms density deviation = 0.23%.

Table 4. Comparisons of second virial coefficients with eq (5).

Data sources and ID numbers: (2)Beattie (1939), (3)Beattie (1942), (4)Bottomley (1964), (5)Bottomley (1977), (19)Kay, (25)Olds, (26)Gunn, (27)Jones, (28)Kapallo, (29)Sage, (30)Kretschmer, (31)McGlashan, (32)Tripp, (33)Strein, (35)Das, (37)Connolly.

ID	Weight	Temp. K	T/T_c	B cm^3/mol	B_r(expt)	B_r(calc)	Diff.	Diff. %
28	1.000	244.00	.574	-1230.00	-4.822	-4.838	.017	.34
4	1.000	273.06	.642	-897.00	-3.516	-3.649	.133	3.65
28	1.000	273.40	.643	-923.00	-3.618	-3.638	.020	.55
35	1.000	280.00	.659	-902.00	-3.536	-3.430	-.106	-3.10
28	1.000	282.30	.664	-862.00	-3.379	-3.361	-.018	-.53
32	1.000	283.16	.666	-846.00	-3.316	-3.336	.020	.59
32	1.000	283.16	.666	-862.00	-3.379	-3.336	-.043	-1.29
32	1.000	283.16	.666	-862.00	-3.379	-3.336	-.043	-1.29
32	1.000	283.16	.666	-881.00	-3.454	-3.336	-.117	-3.52
35	1.000	290.00	.682	-825.00	-3.234	-3.146	-.088	-2.80
33	1.000	296.10	.696	-743.00	-2.913	-2.990	.077	2.58
28	1.000	297.00	.699	-758.00	-2.971	-2.968	-.004	-.12
4	1.000	297.14	.699	-735.00	-2.881	-2.964	.083	2.80
35	1.000	300.00	.706	-757.00	-2.967	-2.896	-.072	-2.47
32	1.000	303.04	.713	-745.00	-2.920	-2.826	-.095	-3.36
32	1.000	303.04	.713	-715.00	-2.803	-2.826	.023	.81
32	1.000	303.04	.713	-691.00	-2.709	-2.826	.117	4.14
32	1.000	303.04	.713	-695.00	-2.724	-2.826	.101	3.58
28	1.000	305.60	.719	-718.00	-2.815	-2.768	-.046	-1.67
33	1.000	309.50	.728	-661.00	-2.591	-2.684	.093	3.48
25	1.000	310.94	.731	-707.60	-2.774	-2.654	-.119	-4.50
28	1.000	312.00	.734	-674.00	-2.642	-2.633	-.009	-.36
35	1.000	320.00	.753	-644.00	-2.524	-2.476	-.048	-1.94
28	1.000	321.00	.755	-635.00	-2.489	-2.458	-.031	-1.27
32	1.000	323.21	.760	-599.00	-2.348	-2.418	.070	2.88
32	1.000	323.21	.760	-602.00	-2.360	-2.418	.058	2.39
32	1.000	323.21	.760	-619.00	-2.426	-2.418	-.009	-.37
32	1.000	323.21	.760	-641.00	-2.513	-2.418	-.095	-3.93
4	1.000	323.16	.760	-606.00	-2.376	-2.419	.043	1.78
4	1.000	325.68	.766	-595.00	-2.332	-2.374	.041	1.74
33	1.000	334.60	.787	-555.70	-2.178	-2.225	.046	2.08
35	1.000	340.00	.800	-554.00	-2.172	-2.141	-.031	-1.43
25	1.000	344.27	.810	-544.20	-2.133	-2.078	-.055	-2.65
26	1.000	344.30	.810	-505.70	-1.982	-2.078	.095	4.60
4	1.000	346.46	.815	-522.00	-2.046	-2.047	.001	.04
33	1.000	353.10	.831	-489.20	-1.918	-1.957	.039	1.99
35	1.000	360.00	.847	-481.00	-1.886	-1.869	-.017	-.90
27	1.000	368.25	.866	-443.49	-1.738	-1.771	.033	1.84
27	1.000	368.25	.866	-444.20	-1.741	-1.771	.030	1.68
4	1.000	370.86	.872	-449.00	-1.760	-1.742	-.018	-1.06
27	1.000	373.22	.878	-427.53	-1.676	-1.716	.040	2.32
27	1.000	373.22	.878	-429.50	-1.684	-1.716	.032	1.87
33	1.000	374.20	.880	-431.80	-1.693	-1.705	.013	.73
25	1.000	377.60	.888	-433.21	-1.698	-1.669	-.029	-1.74
26	1.000	377.60	.888	-424.90	-1.666	-1.669	.004	.21
27	1.000	378.18	.890	-418.30	-1.640	-1.663	.023	1.40
27	1.000	378.18	.890	-418.00	-1.639	-1.663	.025	1.48
35	1.000	380.00	.894	-421.00	-1.650	-1.544	-.006	-.36
33	1.000	393.80	.926	-385.90	-1.513	-1.512	-.001	-.06
4	1.000	397.34	.935	-389.00	-1.525	-1.480	-.045	-3.01
27	1.000	398.14	.936	-370.02	-1.450	-1.473	.023	1.55
27	1.000	398.14	.936	-376.00	-1.474	-1.473	-.001	-.04
35	1.000	400.00	.941	-371.00	-1.454	-1.457	.003	.20
26	1.000	410.90	.966	-353.60	-1.386	-1.368	-.018	-1.33
25	1.000	410.94	.967	-358.02	-1.403	-1.368	-.036	-2.62
33	1.000	413.00	.971	-345.90	-1.356	-1.352	-.004	-.31
35	1.000	420.00	.988	-329.00	-1.290	-1.299	.010	.75
27	1.000	423.14	.995	-325.61	-1.276	-1.277	.000	.04
27	1.000	423.14	.995	-326.10	-1.278	-1.277	-.001	-.12
2	1.000	423.16	.995	-328.75	-1.289	-1.277	-.012	-.94
3	1.000	423.16	.995	-328.70	-1.289	-1.277	-.012	-.92
4	1.000	426.37	1.003	-331.00	-1.298	-1.254	-.043	-3.45
26	1.000	427.60	1.006	-322.10	-1.263	-1.246	-.017	-1.35

Table 4. (Continued).

Data sources and ID numbers: (2)Beattie (1939), (3)Beattie (1942), (4)Bottomley (1964), (5)Bottomley (1977), (19)Kay, (25)Olds, (26)Gunn, (27)Jones, (28)Kapallo, (29)Sage, (30)Kretschmer, (31)McGlashan, (32)Tripp, (33)Strein, (35)Das, (37)Connolly.

ID	Weight	Temp. K	T/T_c	B cm^3/mol	B_r(expt)	B_r(calc)	Diff.	Diff. %
33	1.000	433.30	1.019	-314.30	-1.232	-1.208	-.024	-2.02
35	1.000	440.00	1.035	-294.00	-1.152	-1.165	.012	1.06
25	1.000	444.27	1.045	-289.98	-1.137	-1.139	.002	.18
26	1.000	444.30	1.045	-293.40	-1.150	-1.139	-.012	-1.02
2	1.000	448.16	1.054	-286.14	-1.122	-1.116	-.006	-.54
3	1.000	448.16	1.054	-287.30	-1.126	-1.116	-.011	-.95
27	1.000	448.18	1.054	-286.24	-1.122	-1.116	-.007	-.59
27	1.000	448.18	1.054	-284.80	-1.116	-1.116	-.001	-.08
26	1.000	460.90	1.084	-272.20	-1.067	-1.044	-.023	-2.16
35	1.000	470.00	1.105	-250.00	-.980	-.997	.017	1.74
33	1.000	472.80	1.112	-253.30	-.993	-.983	-.009	-.96
2	1.000	473.16	1.113	-252.71	-.991	-.982	-.009	-.91
3	1.000	473.16	1.113	-254.20	-.996	-.982	-.015	-1.50
27	1.000	473.21	1.113	-255.50	-1.002	-.981	-.020	-2.05
27	1.000	473.21	1.113	-256.30	-1.005	-.981	-.023	-2.37
25	1.000	477.60	1.123	-237.28	-.930	-.960	.030	3.14
26	1.000	477.60	1.123	-245.90	-.964	-.960	-.004	-.38
33	1.000	498.00	1.171	-220.30	-.864	-.870	.006	.69
2	1.000	498.16	1.172	-223.37	-.876	-.869	-.007	-.77
3	1.000	498.16	1.172	-224.50	-.880	-.869	-.011	-1.28
27	1.000	498.20	1.172	-228.48	-.896	-.869	-.027	-3.09
27	1.000	498.20	1.172	-228.70	-.897	-.869	-.028	-3.19
35	1.000	500.00	1.176	-215.00	-.843	-.861	.019	2.16
26	1.000	510.90	1.202	-199.90	-.784	-.818	.035	4.22
25	1.000	510.94	1.202	-198.83	-.779	-.818	.039	4.72
2	1.000	523.16	1.231	-198.19	-.777	-.773	-.004	-.51
3	1.000	523.16	1.231	-198.10	-.777	-.773	-.004	-.47
35	1.000	530.00	1.247	-186.00	-.729	-.749	.020	2.67
35	1.000	560.00	1.317	-161.00	-.631	-.655	.024	3.68
2	1.000	573.16	1.348	-154.09	-.604	-.619	.015	2.38
3	1.000	573.16	1.348	-157.40	-.617	-.619	.002	.28
5	0.000	316.18	.744	-612.30	-2.400	-2.549	.149	5.85
5	0.000	341.49	.803	-518.90	-2.034	-2.119	.085	4.00
5	0.000	341.54	.803	-503.60	-1.974	-2.118	.144	6.80
5	0.000	341.75	.804	-512.00	-2.007	-2.115	.108	5.11
5	0.000	341.83	.804	-513.30	-2.012	-2.114	.102	4.81
5	0.000	367.09	.863	-432.90	-1.697	-1.784	.087	4.90
5	0.000	367.13	.864	-432.30	-1.695	-1.784	.089	5.00
5	0.000	367.83	.865	-435.30	-1.706	-1.776	.069	3.91
5	0.000	367.99	.866	-429.70	-1.684	-1.774	.090	5.05
5	0.000	396.39	.932	-368.60	-1.445	-1.489	.044	2.94
5	0.000	396.46	.932	-367.60	-1.441	-1.488	.047	3.16
5	0.000	396.60	.933	-363.80	-1.426	-1.487	.061	4.08
5	0.000	427.88	1.006	-303.80	-1.191	-1.244	.053	4.26
5	0.000	427.88	1.006	-306.50	-1.201	-1.244	.042	3.41
5	0.000	462.69	1.088	-248.60	-.975	-1.035	.060	5.84
5	0.000	462.86	1.089	-246.60	-.967	-1.034	.067	6.51
5	0.000	463.32	1.090	-243.90	-.956	-1.032	.076	7.32
5	0.000	498.81	1.173	-213.90	-.838	-.866	.028	3.21
5	0.000	498.98	1.174	-201.40	-.789	-.866	.076	8.79
5	0.000	537.16	1.263	-167.10	-.655	-.725	.070	9.68
5	0.000	537.32	1.264	-160.50	-.629	-.725	.096	13.19
5	0.000	537.38	1.264	-158.10	-.620	-.725	.105	14.46
5	0.000	579.46	1.363	-125.90	-.494	-.602	.109	18.05
5	0.000	580.48	1.365	-124.60	-.488	-.600	.111	18.54
19	0.000	310.94	.731	-742.80	-2.912	-2.654	-.257	-9.69
19	0.000	338.72	.797	-585.19	-2.294	-2.161	-.133	-6.18
19	0.000	366.49	.862	-502.69	-1.971	-1.791	-.179	-10.01
19	0.000	394.27	.927	-421.99	-1.654	-1.508	-.147	-9.73
19	0.000	422.05	.993	-333.38	-1.307	-1.285	-.022	-1.73
19	0.000	449.83	1.058	-294.38	-1.154	-1.106	-.048	-4.34
19	0.000	477.60	1.123	-257.05	-1.008	-.960	-.047	-4.93

Table 4. (Continued).

Data sources and ID numbers: (2)Beattie (1939), (3)Beattie (1942), (4)Bottomley (1964), (5)Bottomley (1977), (19)Kay, (25)Olds, (26)Gunn, (27)Jones, (28)Kapallo, (29)Sage, (30)Kretschmer, (31)McGlashan, (32)Tripp, (33)Strein, (35)Das, (37)Connolly.

ID	Weight	Temp. K	T/T_c	B cm^3/mol	B_r(expt)	B_r(calc)	Diff.	Diff. %
19	0.000	505.38	1.189	-223.67	-.877	-.840	-.037	-4.42
19	0.000	533.16	1.254	-201.37	-.789	-.738	-.051	-6.89
19	0.000	560.94	1.319	-182.51	-.715	-.653	-.063	-9.64
19	0.000	588.72	1.385	-168.29	-.660	-.579	-.081	-13.97
29	0.000	310.94	.731	-660.61	-2.590	-2.654	.065	2.44
29	0.000	327.60	.771	-616.33	-2.416	-2.340	-.076	-3.23
29	0.000	344.27	.810	-567.57	-2.225	-2.078	-.147	-7.05
29	0.000	360.94	.849	-523.67	-2.053	-1.857	-.196	-10.53
29	0.000	377.60	.888	-501.54	-1.966	-1.669	-.297	-17.79
29	0.000	394.27	.927	-472.28	-1.851	-1.508	-.344	-22.81
30	0.000	303.16	.713	-761.00	-2.983	-2.823	-.160	-5.68
31	0.000	296.40	.697	-720.00	-2.822	-2.982	.160	5.36
31	0.000	307.50	.723	-667.00	-2.615	-2.727	.112	4.12
31	0.000	318.20	.748	-619.00	-2.426	-2.510	.084	3.34
31	0.000	328.90	.774	-568.00	-2.227	-2.318	.092	3.96
31	0.000	337.80	.795	-533.00	-2.089	-2.175	.085	3.92
31	0.000	348.40	.819	-501.00	-1.964	-2.020	.056	2.78
31	0.000	358.40	.843	-466.00	-1.827	-1.889	.062	3.28
31	0.000	368.40	.866	-440.00	-1.725	-1.769	.045	2.52
31	0.000	377.90	.889	-410.00	-1.607	-1.666	.059	3.53
31	0.000	387.60	.912	-383.00	-1.501	-1.569	.068	4.33
31	0.000	400.40	.942	-353.00	-1.384	-1.454	.070	4.82
31	0.000	413.40	.972	-322.00	-1.262	-1.349	.086	6.40
37	0.000	344.26	.810	-517.00	-2.027	-2.078	.052	2.49
37	0.000	360.93	.849	-464.70	-1.822	-1.857	.036	1.92
37	0.000	377.59	.888	-418.60	-1.641	-1.669	.028	1.70
37	0.000	394.26	.927	-381.30	-1.495	-1.508	.013	.86
37	0.000	406.87	.957	-356.10	-1.396	-1.400	.004	.29
37	0.000	410.93	.967	-348.60	-1.367	-1.368	.001	.09
37	0.000	444.26	1.045	-289.80	-1.136	-1.139	.003	.24

Number of data points = 94; rms deviation = 2.11%.

Table 5. Behavior of coefficients of equation of state for normal butane (eq (6)).

ρ/ρ_c	T_σ K	Θ K	P_σ MPa	$B(\rho)$	$C(\rho)$
.10	348.775	326.499	.9207	.45827	-.52914
.20	379.794	362.591	1.7320	.46342	-.44607
.30	397.551	385.396	2.3859	.47199	-.36821
.40	408.763	400.847	2.8891	.48399	-.29608
.50	415.972	411.292	3.2581	.49942	-.23011
.60	420.518	418.089	3.5131	.51828	-.17061
.70	423.211	422.177	3.6739	.54056	-.11780
.80	424.589	424.282	3.7597	.56628	-.07177
.90	425.091	425.053	3.7916	.59542	-.03254
1.00	425.160	425.160	3.7960	.62800	0.00000
1.10	425.081	425.043	3.7909	.66400	.02603
1.20	424.595	424.287	3.7600	.70343	.04583
1.30	423.384	422.351	3.6845	.74629	.05975
1.40	421.193	418.760	3.5526	.79258	.06819
1.50	417.816	413.115	3.3593	.84230	.07161
1.60	413.099	405.099	3.1062	.89544	.07053
1.70	406.927	394.485	2.8012	.95202	.06547
1.80	399.224	381.141	2.4561	1.01202	.05700
1.90	389.940	365.035	2.0860	1.07546	.04567
2.00	379.049	346.239	1.7079	1.14232	.03203
2.10	366.541	324.930	1.3394	1.21261	.01663
2.20	352.424	301.385	.9975	1.28633	.00000
2.30	336.719	275.985	.6976	1.36347	-.01738
2.40	319.471	249.196	.4511	1.44405	-.03505
2.50	300.745	221.563	.2641	1.52806	-.05259
2.60	280.642	193.688	.1361	1.61549	-.06964
2.70	259.299	166.199	.0592	1.70635	-.08588
2.80	236.894	139.716	.0205	1.80064	-.10103
2.90	213.646	114.817	.0052	1.89836	-.11488
3.00	189.803	91.993	.0008	1.99951	-.12724
3.10	165.632	71.616	.0001	2.10409	-.13800
3.20	141.394	53.922	.0000	2.21210	-.14707
3.30	117.329	38.996	.0000	2.32353	-.15442

Table 6. Calculated P(ρ) critical isotherm of normal butane. (At the critical point $dP_\sigma/dT = (\partial P/\partial T)_{\rho_c} = 0.064272$ MPa/K.)

ρ/ρ_c	T_σ/T_c	P_σ/P_c	P/P_c	$(\partial P/\partial \rho_r,t)_{T_c}$ MPa	$(dT_\sigma/d\rho_r,t)_{T_c}$ K	$(d\Theta/d\rho_r,t)_{T_c}$ K	$(dP_\sigma/d\rho_r,t)_{T_c}$ MPa	$(\partial\Phi/\partial\rho_r,t)_{T_c}$	$(\partial\Psi/\partial\rho_r,t)_{T_c}$
.900	.9998376713	.9988332488	.9999088432	.047280986	6.75607	10.48095	.43300	-.02460	.09444
.905	.9998610479	.9990010816	.9999266355	.040038887	6.07937	9.44128	.38977	-.02213	.08607
.910	.9998820268	.9991517500	.9999416380	.033602636	5.44015	8.45765	.34890	-.01981	.07804
.915	.9999007443	.9992862187	.9999541693	.027921081	4.83829	7.52995	.31039	-.01761	.07035
.920	.9999173362	.9994054508	.9999645268	.022943158	4.27361	6.65803	.27424	-.01556	.06300
.925	.9999319378	.9995104065	.9999729874	.018618028	3.74592	5.84167	.24043	-.01364	.05601
.930	.9999446832	.9996020417	.9999798073	.014895228	3.25493	5.08063	.20896	-.01185	.04939
.935	.9999557058	.9996813066	.9999852221	.011724825	2.80034	4.37458	.17981	-.01019	.04315
.940	.9999651376	.9997491437	.9999894472	.009057571	2.38179	3.72319	.15296	-.00867	.03728
.945	.9999731090	.9998064871	.9999926780	.006845061	1.99886	3.12603	.12839	-.00728	.03181
.950	.9999797491	.9998542604	.9999950905	.005039895	1.65109	2.58266	.10607	-.00601	.02673
.955	.9999852840	.9998940868	.9999968630	.003576953	1.33201	2.08659	.08558	-.00485	.02197
.960	.9999896195	.9999252857	.9999980834	.002453727	1.05388	1.65010	.06772	-.00384	.01772
.965	.9999930032	.9999496380	.9999989025	.001602444	.80931	1.26579	.05201	-.00295	.01389
.970	.9999955563	.9999680139	.9999994226	.000981399	.59775	.93312	.03841	-.00218	.01049
.975	.9999973980	.9999812700	.9999997294	.000550659	.41866	.65156	.02691	-.00152	.00753
.980	.9999986455	.9999902500	.9999998927	.000272229	.27156	.42062	.01745	-.00099	.00502
.985	.9999994146	.9999957863	.9999999673	.000110212	.15603	.23988	.01003	-.00057	.00298
.990	.9999998621	.9999990075	.9999999953	.000025195	.06031	.09757	.00388	-.00022	.00120
.995	.9999999828	.9999998762	.9999999997	.000002766	.01545	.02476	.00099	-.00006	.00033
1.000	1.0000000000	1.0000000000	1.0000000000	.000000000	.00000	.00000	.00000	-.00000	0.00000
1.005	.9999999924	.9999999451	1.0000000001	.000001649	-.01026	-.01957	-.00066	.00004	-.00022
1.010	.9999998245	.9999987363	1.0000000060	.000033096	-.07877	-.11604	-.00506	.00029	-.00157
1.015	.9999992062	.9999942855	1.0000000451	.000151959	-.21005	-.29389	-.01350	.00076	-.00399
1.020	.9999981887	.9999869617	1.0000001468	.000371235	-.35904	-.50810	-.02308	.00131	-.00660
1.025	.9999964613	.9999745277	1.0000003789	.000761562	-.55483	-.78773	-.03566	.00202	-.00991
1.030	.9999940428	.9999571202	1.0000008009	.001343866	-.77830	-1.11367	-.05001	.00283	-.01357
1.035	.9999907471	.9999334010	1.0000015098	.002174986	-1.03608	-1.49255	-.06657	.00377	-.01766
1.040	.9999864507	.9999024823	1.0000026170	.003304153	-1.32738	-1.92359	-.08528	.00483	-.02215
1.045	.9999810327	.9998634960	1.0000042545	.004782501	-1.65152	-2.40609	-.10610	.00601	-.02703
1.050	.9999743746	.9998155918	1.0000065757	.006663054	-2.00790	-2.93945	-.12898	.00731	-.03226
1.055	.9999663598	.9997579351	1.0000097559	.009000714	-2.39597	-3.52312	-.15388	.00872	-.03784
1.060	.9999568737	.9996897059	1.0000139932	.011852264	-2.81524	-4.15662	-.18077	.01025	-.04373
1.065	.9999458036	.9996100975	1.0000195092	.015276368	-3.26526	-4.83948	-.20963	.01189	-.04992
1.070	.9999330380	.9995183162	1.0000265499	.019333577	-3.74562	-5.57128	-.24042	.01364	-.05639
1.075	.9999184673	.9994135799	1.0000353864	.024086334	-4.25591	-6.35162	-.27310	.01549	-.06314
1.080	.9999019828	.9992951183	1.0000463157	.029598987	-4.79577	-7.18012	-.30767	.01746	-.07014
1.085	.9998834777	.9991621722	1.0000596614	.035937792	-5.36484	-8.05643	-.34407	.01953	-.07739
1.090	.9998628460	.9990139933	1.0000757745	.043170924	-5.96279	-8.98019	-.38230	.02171	-.08487
1.095	.9998399830	.9988498435	1.0000950344	.051368485	-6.58929	-9.95108	-.42232	.02399	-.09257
1.100	.9998147854	.9986689955	1.0001178493	.060602513	-7.24402	-10.96878	-.46412	.02637	-.10048

Table 7. Comparisons of experimental P-ρ-T data of normal butane with eq (6).

Summary of P-ρ-T data comparisons.

Authors	Range of Data T(K)	Range of Data P(MPa)	Range of Data ρ(kg/m^3)	No. of Points	Deviations Δρ/ρ,rms (%)	Deviations ΔP/P,mean (%)
Beattie [3]	423-573	1.5 - 36.3	29-494	115	0.54	0.56
Kay [44]	311-589	0.2 - 8.3	5-513	437	0.50	0.43
Olds [51]	311-511	0.07- 68.9	1-632	209	0.27	1.18
Sage [64]	294-394	0.1 - 20.7	2-610	154	0.75	11.27
Haynes [35]	140-300	1.7 - 36.1	572-745	105	0.06	4.55
Virial equation (this report)	300-700	0.2 - 0.6	5.8	41	0.26	0.24

Total number of points used in fit = 907
Overall rms density deviation = 0.42%
Overall mean pressure deviation = 1.09%

Table 7. (Continued)

Data sources and ID numbers: (1)Virial Equation, (3)Beattie, (19)Kay, (25)Olds, (29)Sage (XXXX)Haynes.

ID	Data Point No.	Weight	Temp. K	Density expt mol/L	Density expt kg/m^3	Density calc kg/m^3	Density Diff. %	P_{expt} MPa	P_{calc} MPa	Pressure Diff. %
1	1	1.000	300.000	.100	5.81	5.78	.52	.2310	.2321	-.48
1	2	1.000	310.000	.100	5.81	5.79	.40	.2402	.2411	-.38
1	3	1.000	320.000	.100	5.81	5.80	.30	.2493	.2500	-.28
1	4	1.000	330.000	.100	5.81	5.80	.20	.2583	.2588	-.19
1	5	1.000	340.000	.100	5.81	5.81	.12	.2673	.2676	-.11
1	6	1.000	350.000	.100	5.81	5.81	.05	.2762	.2763	-.04
1	7	1.000	360.000	.100	5.81	5.81	-.02	.2851	.2850	.01
1	8	1.000	370.000	.100	5.81	5.82	-.07	.2939	.2937	.07
1	9	1.000	380.000	.100	5.81	5.82	-.11	.3027	.3024	.11
1	10	1.000	390.000	.100	5.81	5.82	-.15	.3115	.3110	.15
1	11	1.000	400.000	.100	5.81	5.82	-.19	.3202	.3196	.18
1	12	1.000	410.000	.100	5.81	5.82	-.21	.3289	.3283	.21
1	13	1.000	420.000	.100	5.81	5.83	-.24	.3376	.3369	.23
1	14	1.000	430.000	.100	5.81	5.83	-.25	.3463	.3455	.25
1	15	1.000	440.000	.100	5.81	5.83	-.27	.3550	.3540	.26
1	16	1.000	450.000	.100	5.81	5.83	-.28	.3636	.3626	.27
1	17	1.000	460.000	.100	5.81	5.83	-.29	.3722	.3712	.28
1	18	1.000	470.000	.100	5.81	5.83	-.30	.3808	.3797	.29
1	19	1.000	480.000	.100	5.81	5.83	-.30	.3894	.3883	.29
1	20	1.000	490.000	.100	5.81	5.83	-.30	.3980	.3968	.30
1	21	1.000	500.000	.100	5.81	5.83	-.31	.4066	.4054	.30
1	22	1.000	510.000	.100	5.81	5.83	-.31	.4152	.4139	.30
1	23	1.000	520.000	.100	5.81	5.83	-.31	.4237	.4224	.30
1	24	1.000	530.000	.100	5.81	5.83	-.30	.4322	.4310	.30
1	25	1.000	540.000	.100	5.81	5.83	-.30	.4408	.4395	.30
1	26	1.000	550.000	.100	5.81	5.83	-.30	.4493	.4480	.29
1	27	1.000	560.000	.100	5.81	5.83	-.29	.4578	.4565	.29
1	28	1.000	570.000	.100	5.81	5.83	-.29	.4663	.4650	.28
1	29	1.000	580.000	.100	5.81	5.83	-.28	.4748	.4735	.28
1	30	1.000	590.000	.100	5.81	5.83	-.28	.4834	.4820	.27
1	31	1.000	600.000	.100	5.81	5.83	-.27	.4918	.4905	.27
1	32	1.000	610.000	.100	5.81	5.83	-.26	.5003	.4990	.26
1	33	1.000	620.000	.100	5.81	5.83	-.26	.5088	.5075	.25
1	34	1.000	630.000	.100	5.81	5.83	-.25	.5173	.5160	.25
1	35	1.000	640.000	.100	5.81	5.83	-.24	.5258	.5245	.24
1	36	1.000	650.000	.100	5.81	5.83	-.24	.5343	.5330	.24
1	37	1.000	660.000	.100	5.81	5.83	-.23	.5427	.5415	.23
1	38	1.000	670.000	.100	5.81	5.83	-.22	.5512	.5500	.22
1	39	1.000	680.000	.100	5.81	5.82	-.22	.5597	.5585	.21
1	40	1.000	690.000	.100	5.81	5.82	-.21	.5681	.5669	.21
1	41	1.000	700.000	.100	5.81	5.82	-.20	.5766	.5754	.20

Table 7. (Continued)

Data sources and ID numbers: (1)Virial Equation, (3)Beattie, (19)Kay, (25)Olds, (29)Sage (XXXX)Haynes.

ID	Data Point No.	Weight	Temp. K	Density expt mol/L	Density expt kg/m^3	Density calc kg/m^3	Density Diff. %	P_{expt} MPa	P_{calc} MPa	Pressure Diff. %
3	42	1.000	423.150	.500	29.06	28.97	.33	1.4875	1.4915	-.27
3	43	1.000	448.150	.500	29.06	29.00	.22	1.6121	1.6151	-.19
3	44	1.000	473.150	.500	29.06	29.01	.19	1.7337	1.7366	-.17
3	45	1.000	498.150	.500	29.06	29.02	.14	1.8542	1.8566	-.13
3	46	1.000	523.150	.500	29.06	29.04	.09	1.9738	1.9754	-.08
3	47	1.000	548.150	.500	29.06	29.05	.05	2.0924	2.0933	-.04
3	48	1.000	573.150	.500	29.06	29.06	.02	2.2099	2.2104	-.02
3	49	1.000	423.150	1.000	58.12	57.67	.77	2.5007	2.5133	-.50
3	50	1.000	448.150	1.000	58.12	57.67	.79	2.7864	2.8022	-.56
3	51	1.000	473.150	1.000	58.12	57.69	.74	3.0641	3.0814	-.56
3	52	1.000	498.150	1.000	58.12	57.73	.68	3.3356	3.3539	-.54
3	53	1.000	523.150	1.000	58.12	57.75	.64	3.6021	3.6213	-.53
3	54	1.000	548.150	1.000	58.12	57.84	.49	3.8686	3.8850	-.42
3	55	1.000	573.150	1.000	58.12	57.87	.43	4.1300	4.1456	-.38
3	56	1.000	423.150	1.500	87.19	86.46	.83	3.1350	3.1469	-.38
3	57	1.000	448.150	1.500	87.19	86.31	1.00	3.6153	3.6360	-.57
3	58	1.000	473.150	1.500	87.19	86.31	1.01	4.0753	4.1022	-.65
3	59	1.000	498.150	1.500	87.19	86.44	.85	4.5262	4.5538	-.61
3	60	1.000	523.150	1.500	87.19	86.51	.77	4.9659	4.9951	-.58
3	61	1.000	548.150	1.500	87.19	86.68	.58	5.4037	5.4287	-.46
3	62	1.000	573.150	1.500	87.19	86.79	.45	5.8343	5.8562	-.37
3	63	1.000	423.150	2.000	116.25	115.51	.63	3.4846	3.4905	-.17
3	64	1.000	448.150	2.000	116.25	115.22	.89	4.1857	4.2023	-.39
3	65	1.000	473.150	2.000	116.25	115.24	.87	4.8514	4.8750	-.48
3	66	1.000	498.150	2.000	116.25	115.44	.70	5.5009	5.5257	-.45
3	67	1.000	523.150	2.000	116.25	115.74	.43	6.1423	6.1612	-.31
3	68	1.000	548.150	2.000	116.25	115.91	.29	6.7705	6.7856	-.22
3	69	1.000	573.150	2.000	116.25	116.10	.13	7.3937	7.4012	-.10
3	70	1.000	423.150	2.500	145.31	144.87	.30	3.6406	3.6419	-.04
3	71	1.000	448.150	2.500	145.31	144.31	.69	4.5748	4.5859	-.24
3	72	1.000	473.150	2.500	145.31	144.55	.52	5.4634	5.4776	-.26
3	73	1.000	498.150	2.500	145.31	144.91	.28	6.3328	6.3433	-.17
3	74	1.000	523.150	2.500	145.31	145.17	.10	7.1870	7.1918	-.07
3	75	1.000	548.150	2.500	145.31	145.59	-.19	8.0391	8.0275	.15
3	76	1.000	573.150	2.500	145.31	145.84	-.36	8.8791	8.8531	.29
3	77	1.000	448.150	3.000	174.37	173.57	.46	4.8525	4.8591	-.14
3	78	1.000	473.150	3.000	174.37	174.12	.15	5.9772	5.9813	-.07
3	79	1.000	498.150	3.000	174.37	174.60	-.13	7.0857	7.0801	.08
3	80	1.000	523.150	3.000	174.37	174.91	-.31	8.1810	8.1632	.22
3	81	1.000	548.150	3.000	174.37	175.44	-.61	9.2793	9.2344	.49
3	82	1.000	573.150	3.000	174.37	175.70	-.76	10.3635	10.2961	.65
3	83	1.000	448.150	3.500	203.44	202.22	.60	5.0744	5.0835	-.18
3	84	1.000	473.150	3.500	203.44	203.09	.17	6.4493	6.4551	-.09
3	85	1.000	498.150	3.500	203.44	203.85	-.21	7.8233	7.8124	.14
3	86	1.000	523.150	3.500	203.44	204.21	-.38	9.1871	9.1594	.30
3	87	1.000	548.150	3.500	203.44	204.86	-.70	10.5631	10.4980	.62
3	88	1.000	573.150	3.500	203.44	205.17	-.85	11.9260	11.8292	.82
3	89	1.000	448.150	4.000	232.50	229.40	1.33	5.2861	5.3118	-.48
3	90	1.000	448.150	4.000	232.50	229.77	1.17	5.2892	5.3118	-.43
3	91	1.000	473.150	4.000	232.50	231.80	.30	6.9519	6.9650	-.19
3	92	1.000	473.150	4.000	232.50	231.15	.58	6.9397	6.9650	-.36
3	93	1.000	498.150	4.000	232.50	232.98	-.21	8.6329	8.6183	.17
3	94	1.000	498.150	4.000	232.50	232.27	.10	8.6116	8.6183	-.08
3	95	1.000	523.150	4.000	232.50	233.69	-.51	10.3189	10.2698	.48
3	96	1.000	523.150	4.000	232.50	232.90	-.17	10.2865	10.2698	.16

Table 7. (Continued)

Data sources and ID numbers: (1)Virial Equation, (3)Beattie, (19)Kay, (25)Olds, (29)Sage, (XXXX)Haynes.

ID	Data Point No.	Weight	Temp. K	Density expt mol/L	Density expt kg/m^3	Density calc kg/m^3	Density Diff. %	P_{expt} MPa	P_{calc} MPa	Pressure Diff. %
3	97	1.000	548.150	4.000	232.50	234.31	-.78	12.0141	11.9183	.80
3	98	1.000	548.150	4.000	232.50	233.66	-.50	11.9797	11.9183	.51
3	99	1.000	573.150	4.000	232.50	234.71	-.95	13.7062	13.5629	1.06
3	100	1.000	573.150	4.000	232.50	234.09	-.68	13.6657	13.5629	.76
3	101	1.000	448.150	4.500	261.56	257.05	1.72	5.5354	5.5818	-.83
3	102	1.000	473.150	4.500	261.56	259.28	.87	7.5143	7.5663	-.69
3	103	1.000	498.150	4.500	261.56	260.68	.34	9.5367	9.5684	-.33
3	104	1.000	523.150	4.500	261.56	261.49	.03	11.5754	11.5789	-.03
3	105	1.000	548.150	4.500	261.56	262.27	-.27	13.6383	13.5930	.33
3	106	1.000	573.150	4.500	261.56	262.67	-.42	15.6932	15.6074	.55
3	107	1.000	425.160	5.000	290.62	288.79	.63	3.8260	3.8302	-.11
3	108	1.000	448.150	5.000	290.62	287.60	1.04	5.9072	5.9536	-.78
3	109	1.000	448.150	5.000	290.62	286.51	1.41	5.8910	5.9536	-1.05
3	110	1.000	473.150	5.000	290.62	289.42	.41	8.3046	8.3417	-.44
3	111	1.000	473.150	5.000	290.62	288.16	.85	8.2661	8.3417	-.91
3	112	1.000	498.150	5.000	290.62	290.60	.01	10.7638	10.7647	-.01
3	113	1.000	498.150	5.000	290.62	289.54	.37	10.7141	10.7647	-.47
3	114	1.000	523.150	5.000	290.62	291.36	-.25	13.2533	13.2064	.35
3	115	1.000	523.150	5.000	290.62	290.35	.09	13.1895	13.2064	-.13
3	116	1.000	548.150	5.000	290.62	291.95	-.46	15.7652	15.6581	.68
3	117	1.000	548.150	5.000	290.62	290.93	-.11	15.6831	15.6581	.16
3	118	1.000	573.150	5.000	290.62	292.48	-.64	18.2952	18.1142	1.00
3	119	1.000	573.150	5.000	290.62	291.32	-.24	18.1818	18.1142	.37
3	120	1.000	425.160	5.500	319.68	318.19	.47	3.9669	3.9798	-.33
3	121	1.000	448.150	5.500	319.68	317.90	.56	6.5041	6.5506	-.71
3	122	1.000	473.150	5.500	319.68	318.97	.22	9.4101	9.4425	-.34
3	123	1.000	498.150	5.500	319.68	319.80	-.04	12.3900	12.3822	.06
3	124	1.000	523.150	5.500	319.68	320.41	-.23	15.4105	15.3483	.41
3	125	1.000	548.150	5.500	319.68	320.87	-.37	18.4553	18.3291	.69
3	126	1.000	573.150	5.500	319.68	321.27	-.50	21.5174	21.3169	.94
3	127	1.000	425.160	6.000	348.75	347.41	.38	4.3975	4.4284	-.70
3	128	1.000	448.150	6.000	348.75	347.61	.32	7.5305	7.5823	-.68
3	129	1.000	473.150	6.000	348.75	348.17	.16	11.0677	11.1081	-.36
3	130	1.000	498.150	6.000	348.75	348.83	-.02	14.6942	14.6861	.05
3	131	1.000	523.150	6.000	348.75	349.23	-.14	18.3510	18.2935	.31
3	132	1.000	548.150	6.000	348.75	349.59	-.24	22.0382	21.9166	.55
3	133	1.000	573.150	6.000	348.75	349.85	-.32	25.7325	25.5466	.73
3	134	1.000	425.160	6.500	377.81	376.37	.38	5.4047	5.4769	-1.32
3	135	1.000	448.150	6.500	377.81	376.76	.28	9.2885	9.3713	-.88
3	136	1.000	473.150	6.500	377.81	377.15	.17	13.6171	13.6886	-.52
3	137	1.000	498.150	6.500	377.81	377.58	.06	18.0207	18.0530	-.18
3	138	1.000	523.150	6.500	377.81	377.88	-.02	22.4556	22.4427	.06
3	139	1.000	548.150	6.500	377.81	378.11	-.08	26.9048	26.8444	.23
3	140	1.000	573.150	6.500	377.81	378.32	-.14	31.3662	31.2488	.38
3	141	1.000	425.160	7.000	406.87	405.33	.38	7.4241	7.5699	-1.93
3	142	1.000	448.150	7.000	406.87	405.63	.31	12.2188	12.3801	-1.30
3	143	1.000	473.150	7.000	406.87	405.95	.23	17.5161	17.6701	-.87
3	144	1.000	498.150	7.000	406.87	406.24	.16	22.8640	22.9929	-.56
3	145	1.000	523.150	7.000	406.87	406.41	.11	28.2200	28.3301	-.39
3	146	1.000	548.150	7.000	406.87	406.47	.10	33.5588	33.6696	-.33
3	147	1.000	425.160	7.500	435.93	434.23	.39	11.0404	11.3183	-2.46
3	148	1.000	448.150	7.500	435.93	434.54	.32	16.9507	17.2358	-1.65
3	149	1.000	473.150	7.500	435.93	434.63	.30	23.3767	23.7006	-1.37
3	150	1.000	498.150	7.500	435.93	434.94	.23	29.8848	30.1760	-.97
3	151	1.000	523.150	7.500	435.93	434.98	.22	36.3281	36.6481	-.87
3	152	1.000	425.160	8.000	464.99	463.13	.40	17.0337	17.5247	-2.80
3	153	1.000	448.150	8.000	464.99	463.42	.34	24.2663	24.7575	-1.98
3	154	1.000	473.150	8.000	464.99	463.27	.37	31.9893	32.6184	-1.93
3	155	1.000	425.160	8.500	494.06	492.07	.40	26.4134	27.2128	-2.94
3	156	1.000	448.150	8.500	494.06	492.26	.36	35.1618	35.9860	-2.29

Table 7. (Continued)

Data sources and ID numbers: (1)Virial Equation, (3)Beattie, (19)Kay, (25)Olds, (29)Sage, (XXXX)Haynes.

ID	Data Point No.	Weight	Temp. K	Density expt mol/L	Density expt kg/m^3	Density calc kg/m^3	Density Diff. %	P_{expt} MPa	P_{calc} MPa	Pressure Diff. %
19	157	1.000	310.928	.079	4.58	4.56	.41	.1924	.1931	-.39
19	158	1.000	338.706	.079	4.58	4.57	.23	.2117	.2121	-.22
19	159	1.000	366.483	.079	4.58	4.58	.01	.2310	.2310	-.01
19	160	1.000	394.261	.079	4.58	4.57	.07	.2496	.2498	-.07
19	161	1.000	422.039	.079	4.58	4.58	-.17	.2689	.2684	.17
19	162	1.000	449.817	.079	4.58	4.58	-.15	.2875	.2871	.15
19	163	1.000	477.594	.079	4.58	4.57	.08	.3054	.3057	-.08
19	164	1.000	505.372	.079	4.58	4.57	.06	.3241	.3242	-.06
19	165	1.000	533.150	.079	4.58	4.57	.04	.3427	.3428	-.04
19	166	1.000	560.928	.079	4.58	4.57	.20	.3606	.3613	-.20
19	167	1.000	588.706	.079	4.58	4.57	.17	.3792	.3798	-.17
19	168	1.000	310.928	.085	4.93	4.90	.52	.2062	.2072	-.49
19	169	1.000	338.706	.085	4.93	4.92	.10	.2275	.2277	-.09
19	170	1.000	366.483	.085	4.93	4.92	.25	.2475	.2481	-.24
19	171	1.000	394.261	.085	4.93	4.94	-.21	.2689	.2684	.20
19	172	1.000	422.039	.085	4.93	4.95	-.37	.2896	.2885	.36
19	173	1.000	449.817	.085	4.93	4.93	-.08	.3089	.3086	.08
19	174	1.000	477.594	.085	4.93	4.93	-.05	.3289	.3287	.05
19	175	1.000	505.372	.085	4.93	4.93	-.04	.3489	.3487	.04
19	176	1.000	533.150	.085	4.93	4.92	.16	.3682	.3687	-.15
19	177	1.000	560.928	.085	4.93	4.92	.15	.3882	.3887	-.14
19	178	1.000	588.706	.085	4.93	4.91	.30	.4075	.4087	-.30
19	179	1.000	310.928	.092	5.34	5.32	.33	.2227	.2234	-.31
19	180	1.000	338.706	.092	5.34	5.33	.15	.2455	.2458	-.14
19	181	1.000	366.483	.092	5.34	5.33	.17	.2675	.2680	-.16
19	182	1.000	394.261	.092	5.34	5.33	.14	.2896	.2900	-.13
19	183	1.000	422.039	.092	5.34	5.35	-.15	.3123	.3119	.15
19	184	1.000	449.817	.092	5.34	5.34	.00	.3337	.3337	-.00
19	185	1.000	477.594	.092	5.34	5.33	.12	.3551	.3555	-.12
19	186	1.000	505.372	.092	5.34	5.34	.03	.3771	.3772	-.03
19	187	1.000	533.150	.092	5.34	5.33	.11	.3985	.3990	-.11
19	188	1.000	560.928	.092	5.34	5.33	.18	.4199	.4206	-.18
19	189	1.000	588.706	.092	5.34	5.33	.24	.4413	.4423	-.24
19	190	1.000	310.928	.100	5.82	5.80	.47	.2413	.2424	-.44
19	191	1.000	338.706	.100	5.82	5.82	.05	.2668	.2670	-.05
19	192	1.000	366.483	.100	5.82	5.82	.10	.2910	.2912	-.10
19	193	1.000	394.261	.100	5.82	5.82	.08	.3151	.3153	-.08
19	194	1.000	422.039	.100	5.82	5.84	-.18	.3399	.3393	.17
19	195	1.000	449.817	.100	5.82	5.83	-.04	.3634	.3632	.04
19	196	1.000	477.594	.100	5.82	5.82	.07	.3868	.3870	-.06
19	197	1.000	505.372	.100	5.82	5.83	-.03	.4109	.4108	.03
19	198	1.000	533.150	.100	5.82	5.82	.04	.4344	.4346	-.04
19	199	1.000	560.928	.100	5.82	5.81	.25	.4571	.4583	-.25
19	200	1.000	588.706	.100	5.82	5.82	.15	.4813	.4820	-.14
19	201	1.000	310.928	.110	6.41	6.39	.32	.2641	.2649	-.30
19	202	1.000	338.706	.110	6.41	6.40	.16	.2916	.2921	-.15
19	203	1.000	366.483	.110	6.41	6.38	.36	.3178	.3190	-.35
19	204	1.000	394.261	.110	6.41	6.40	.05	.3454	.3456	-.05
19	205	1.000	422.039	.110	6.41	6.41	-.07	.3723	.3721	.07
19	206	1.000	449.817	.110	6.41	6.41	-.02	.3985	.3984	.02
19	207	1.000	477.594	.110	6.41	6.42	-.16	.4254	.4247	.16
19	208	1.000	505.372	.110	6.41	6.41	.01	.4509	.4510	-.01
19	209	1.000	533.150	.110	6.41	6.40	.15	.4764	.4771	-.15
19	210	1.000	560.928	.110	6.41	6.40	.13	.5026	.5033	-.13
19	211	1.000	588.706	.110	6.41	6.39	.24	.5281	.5294	-.24

Table 7. (Continued)

Data sources and ID numbers: (1)Virial Equation, (3)Beattie, (19)Kay, (25)Olds, (29)Sage, (XXXX)Haynes.

ID	Data Point No.	Weight	Temp. K	Density expt mol/L	Density expt kg/m^3	Density calc kg/m^3	Density Diff. %	P_{expt} MPa	P_{calc} MPa	Pressure Diff. %
19	212	1.000	310.928	.122	7.12	7.09	.35	.2910	.2919	-.32
19	213	1.000	338.706	.122	7.12	7.11	.15	.3220	.3224	-.14
19	214	1.000	366.483	.122	7.12	7.10	.25	.3516	.3525	-.24
19	215	1.000	394.261	.122	7.12	7.11	.07	.3820	.3822	-.07
19	216	1.000	422.039	.122	7.12	7.13	-.13	.4123	.4118	.12
19	217	1.000	449.817	.122	7.12	7.12	-.01	.4413	.4412	.01
19	218	1.000	477.594	.122	7.12	7.11	.07	.4702	.4705	-.07
19	219	1.000	505.372	.122	7.12	7.12	-.02	.4999	.4998	.02
19	220	1.000	533.150	.122	7.12	7.12	.03	.5288	.5290	-.03
19	221	1.000	560.928	.122	7.12	7.11	.06	.5578	.5581	-.06
19	222	1.000	588.706	.122	7.12	7.10	.20	.5861	.5872	-.20
19	223	1.000	310.928	.138	8.01	7.97	.54	.3234	.3250	-.49
19	224	1.000	338.706	.138	8.01	7.98	.36	.3585	.3597	-.33
19	225	1.000	366.483	.138	8.01	7.99	.23	.3930	.3938	-.21
19	226	1.000	394.261	.138	8.01	8.01	.02	.4275	.4276	-.02
19	227	1.000	422.039	.138	8.01	8.01	-.06	.4613	.4610	.05
19	228	1.000	449.817	.138	8.01	8.01	-.01	.4944	.4943	.01
19	229	1.000	477.594	.138	8.01	8.00	.13	.5268	.5274	-.13
19	230	1.000	505.372	.138	8.01	8.01	-.01	.5605	.5605	.01
19	231	1.000	533.150	.138	8.01	8.00	.09	.5929	.5935	-.09
19	232	1.000	560.928	.138	8.01	8.01	.05	.6260	.6264	-.05
19	233	1.000	588.706	.138	8.01	8.00	.12	.6584	.6592	-.12
19	234	1.000	338.706	.157	9.15	9.14	.16	.4061	.4067	-.15
19	235	1.000	366.483	.157	9.15	9.14	.18	.4454	.4461	-.16
19	236	1.000	394.261	.157	9.15	9.13	.22	.4840	.4850	-.21
19	237	1.000	422.039	.157	9.15	9.15	.05	.5233	.5236	-.05
19	238	1.000	449.817	.157	9.15	9.14	.12	.5612	.5619	-.11
19	239	1.000	477.594	.157	9.15	9.16	-.10	.6005	.6000	.09
19	240	1.000	505.372	.157	9.15	9.16	-.08	.6385	.6380	.08
19	241	1.000	533.150	.157	9.15	9.15	.02	.6757	.6758	-.02
19	242	1.000	560.928	.157	9.15	9.15	.00	.7136	.7136	-.00
19	243	1.000	588.706	.157	9.15	9.15	.07	.7508	.7514	-.07
19	244	1.000	338.706	.184	10.68	10.66	.19	.4668	.4676	-.17
19	245	1.000	366.483	.184	10.68	10.68	-.01	.5143	.5143	.01
19	246	1.000	394.261	.184	10.68	10.66	.21	.5592	.5603	-.19
19	247	1.000	422.039	.184	10.68	10.67	.06	.6054	.6057	-.06
19	248	1.000	449.817	.184	10.68	10.67	.10	.6502	.6508	-.10
19	249	1.000	477.594	.184	10.68	10.69	-.11	.6964	.6956	.10
19	250	1.000	505.372	.184	10.68	10.68	-.03	.7405	.7403	.03
19	251	1.000	533.150	.184	10.68	10.70	-.16	.7860	.7848	.15
19	252	1.000	560.928	.184	10.68	10.68	-.03	.8294	.8292	.03
19	253	1.000	588.706	.184	10.68	10.67	.07	.8729	.8735	-.07
19	254	1.000	338.706	.197	11.44	11.40	.34	.4957	.4972	-.30
19	255	1.000	366.483	.197	11.44	11.42	.20	.5468	.5477	-.18
19	256	1.000	394.261	.197	11.44	11.42	.16	.5964	.5973	-.15
19	257	1.000	422.039	.197	11.44	11.44	.03	.6460	.6462	-.03
19	258	1.000	449.817	.197	11.44	11.43	.07	.6943	.6948	-.07
19	259	1.000	477.594	.197	11.44	11.45	-.03	.7433	.7430	.03
19	260	1.000	505.372	.197	11.44	11.46	-.15	.7922	.7910	.15
19	261	1.000	533.150	.197	11.44	11.43	.06	.8384	.8389	-.06
19	262	1.000	560.928	.197	11.44	11.45	-.09	.8874	.8866	.08
19	263	1.000	588.706	.197	11.44	11.44	-.00	.9342	.9342	.00
19	264	1.000	338.706	.212	12.32	12.30	.14	.5302	.5308	-.12
19	265	1.000	366.483	.212	12.32	12.30	.20	.5847	.5857	-.18
19	266	1.000	394.261	.212	12.32	12.30	.18	.6385	.6395	-.16
19	267	1.000	422.039	.212	12.32	12.32	.05	.6922	.6925	-.05

Table 7. (Continued)

Data sources and ID numbers: (1)Virial Equation, (3)Beattie, (19)Kay, (25)Olds, (29)Sage, (XXXX)Haynes.

ID	Data Point No.	Weight	Temp. K	Density expt mol/L	Density expt kg/m^3	Density calc kg/m^3	Density Diff. %	P_{expt} MPa	P_{calc} MPa	Pressure Diff. %
19	268	1.000	449.817	.212	12.32	12.31	.07	.7446	.7451	-.06
19	269	1.000	477.594	.212	12.32	12.35	-.23	.7991	.7973	.22
19	270	1.000	505.372	.212	12.32	12.36	-.27	.8515	.8493	.26
19	271	1.000	533.150	.212	12.32	12.35	-.25	.9032	.9010	.24
19	272	1.000	560.928	.212	12.32	12.35	-.25	.9549	.9526	.25
19	273	1.000	588.706	.212	12.32	12.33	-.05	1.0046	1.0040	.05
19	274	1.000	338.706	.230	13.35	13.30	.36	.5674	.5692	-.31
19	275	1.000	366.483	.230	13.35	13.32	.22	.6281	.6294	-.20
19	276	1.000	394.261	.230	13.35	13.33	.11	.6874	.6881	-.10
19	277	1.000	422.039	.230	13.35	13.32	.20	.7446	.7460	-.18
19	278	1.000	449.817	.230	13.35	13.35	.01	.8032	.8033	-.01
19	279	1.000	477.594	.230	13.35	13.38	-.21	.8618	.8602	.19
19	280	1.000	505.372	.230	13.35	13.41	-.42	.9205	.9167	.40
19	281	1.000	533.150	.230	13.35	13.40	-.42	.9770	.9731	.40
19	282	1.000	560.928	.230	13.35	13.38	-.23	1.0315	1.0292	.22
19	283	1.000	588.706	.230	13.35	13.37	-.14	1.0866	1.0852	.13
19	284	1.000	338.706	.251	14.56	14.57	-.05	.6136	.6134	.05
19	285	1.000	366.483	.251	14.56	14.54	.12	.6791	.6799	-.11
19	286	1.000	394.261	.251	14.56	14.55	.10	.7439	.7446	-.09
19	287	1.000	422.039	.251	14.56	14.56	.03	.8081	.8083	-.03
19	288	1.000	449.817	.251	14.56	14.57	-.02	.8715	.8713	.02
19	289	1.000	477.594	.251	14.56	14.60	-.29	.9363	.9338	.27
19	290	1.000	505.372	.251	14.56	14.63	-.48	1.0004	.9958	.46
19	291	1.000	533.150	.251	14.56	14.63	-.48	1.0625	1.0576	.46
19	292	1.000	560.928	.251	14.56	14.61	-.31	1.1225	1.1192	.29
19	293	1.000	588.706	.251	14.56	14.59	-.17	1.1825	1.1805	.16
19	294	1.000	338.706	.276	16.02	16.00	.12	.6640	.6646	-.10
19	295	1.000	366.483	.276	16.02	16.00	.09	.7384	.7390	-.08
19	296	1.000	394.261	.276	16.02	15.98	.23	.8094	.8111	-.21
19	297	1.000	422.039	.276	16.02	16.03	-.07	.8825	.8819	.07
19	298	1.000	449.817	.276	16.02	16.05	-.19	.9535	.9518	.18
19	299	1.000	477.594	.276	16.02	16.11	-.58	1.0266	1.0211	.54
19	300	1.000	505.372	.276	16.02	16.12	-.62	1.0963	1.0899	.58
19	301	1.000	533.150	.276	16.02	16.10	-.50	1.1638	1.1583	.48
19	302	1.000	560.928	.276	16.02	16.08	-.36	1.2307	1.2264	.35
19	303	1.000	588.706	.276	16.02	16.04	-.15	1.2962	1.2943	.14
19	304	1.000	338.706	.306	17.80	17.86	-.34	.7267	.7247	.27
19	305	1.000	366.483	.306	17.80	17.79	.05	.8088	.8091	-.05
19	306	1.000	394.261	.306	17.80	17.76	.23	.8887	.8905	-.20
19	307	1.000	422.039	.306	17.80	17.81	-.07	.9708	.9702	.06
19	308	1.000	449.817	.306	17.80	17.84	-.21	1.0508	1.0487	.19
19	309	1.000	477.594	.306	17.80	17.88	-.48	1.1314	1.1264	.44
19	310	1.000	505.372	.306	17.80	17.89	-.51	1.2093	1.2035	.48
19	311	1.000	533.150	.306	17.80	17.88	-.47	1.2859	1.2802	.44
19	312	1.000	560.928	.306	17.80	17.86	-.35	1.3610	1.3565	.34
19	313	1.000	588.706	.306	17.80	17.82	-.12	1.4341	1.4325	.12
19	314	1.000	366.483	.344	20.02	20.05	-.11	.8942	.8934	.09
19	315	1.000	394.261	.344	20.02	20.00	.10	.9860	.9868	-.09
19	316	1.000	422.039	.344	20.02	20.05	-.12	1.0790	1.0779	.11
19	317	1.000	449.817	.344	20.02	20.11	-.44	1.1721	1.1674	.40
19	318	1.000	477.594	.344	20.02	20.12	-.50	1.2617	1.2559	.46
19	319	1.000	505.372	.344	20.02	20.14	-.56	1.3507	1.3436	.52
19	320	1.000	533.150	.344	20.02	20.13	-.56	1.4382	1.4307	.52
19	321	1.000	560.928	.344	20.02	20.11	-.44	1.5237	1.5174	.42
19	322	1.000	588.706	.344	20.02	20.06	-.19	1.6065	1.6036	.18
19	323	1.000	366.483	.394	22.88	22.92	-.16	.9977	.9964	.13

Table 7. (Continued)

Data sources and ID numbers: (1)Virial Equation, (3)Beattie, (19)Kay, (25)Olds, (29)Sage, (XXXX)Haynes.

ID	Data Point No.	Weight	Temp. K	Density expt mol/L	Density expt kg/m^3	Density calc kg/m^3	Density Diff. %	P_{expt} MPa	P_{calc} MPa	Pressure Diff. %
19	324	1.000	394.261	.394	22.88	22.87	.07	1.1052	1.1059	-.06
19	325	1.000	422.039	.394	22.88	22.90	-.07	1.2128	1.2121	.06
19	326	1.000	449.817	.394	22.88	22.91	-.12	1.3176	1.3162	.10
19	327	1.000	477.594	.394	22.88	22.99	-.48	1.4251	1.4189	.44
19	328	1.000	505.372	.394	22.88	23.04	-.67	1.5299	1.5206	.62
19	329	1.000	533.150	.394	22.88	23.06	-.79	1.6334	1.6214	.74
19	330	1.000	560.928	.394	22.88	23.04	-.68	1.7327	1.7217	.64
19	331	1.000	588.706	.394	22.88	23.05	-.73	1.8340	1.8214	.69
19	332	1.000	366.483	.459	26.70	26.77	-.28	1.1266	1.1242	.21
19	333	1.000	394.261	.459	26.70	26.66	.15	1.2548	1.2564	-.12
19	334	1.000	422.039	.459	26.70	26.67	.11	1.3824	1.3837	-.09
19	335	1.000	449.817	.459	26.70	26.72	-.09	1.5093	1.5080	.08
19	336	1.000	477.594	.459	26.70	26.78	-.30	1.6347	1.6303	.27
19	337	1.000	505.372	.459	26.70	26.84	-.53	1.7595	1.7511	.48
19	338	1.000	533.150	.459	26.70	26.86	-.63	1.8816	1.8708	.58
19	339	1.000	560.928	.459	26.70	26.89	-.72	2.0029	1.9896	.67
19	340	1.000	588.706	.459	26.70	26.86	-.59	2.1194	2.1077	.56
19	341	1.000	366.483	.501	29.12	29.30	-.59	1.2052	1.2000	.43
19	342	1.000	394.261	.501	29.12	29.10	.08	1.3465	1.3473	-.06
19	343	1.000	422.039	.501	29.12	29.12	.00	1.4886	1.4886	-.00
19	344	1.000	449.817	.501	29.12	29.14	-.07	1.6272	1.6262	.06
19	345	1.000	477.594	.501	29.12	29.21	-.28	1.7657	1.7613	.25
19	346	1.000	505.372	.501	29.12	29.27	-.49	1.9030	1.8947	.44
19	347	1.000	533.150	.501	29.12	29.26	-.47	2.0353	2.0266	.43
19	348	1.000	560.928	.501	29.12	29.25	-.44	2.1663	2.1575	.41
19	349	1.000	588.706	.501	29.12	29.24	-.39	2.2960	2.2875	.37
19	350	1.000	366.483	.551	32.04	32.21	-.54	1.2900	1.2852	.38
19	351	1.000	394.261	.551	32.04	31.97	.21	1.4493	1.4516	-.16
19	352	1.000	422.039	.551	32.04	31.98	.18	1.6079	1.6102	-.15
19	353	1.000	449.817	.551	32.04	32.06	-.06	1.7651	1.7642	.05
19	354	1.000	477.594	.551	32.04	32.12	-.27	1.9195	1.9151	.23
19	355	1.000	533.150	.551	32.04	32.20	-.50	2.2208	2.2107	.46
19	356	1.000	560.928	.551	32.04	32.21	-.55	2.3683	2.3564	.51
19	357	1.000	588.706	.551	32.04	32.16	-.37	2.5097	2.5011	.35
19	358	1.000	394.261	.612	35.60	35.56	.11	1.5706	1.5719	-.08
19	359	1.000	422.039	.612	35.60	35.57	.09	1.7513	1.7525	-.07
19	360	1.000	449.817	.612	35.60	35.61	-.04	1.9278	1.9271	.03
19	361	1.000	477.594	.612	35.60	35.66	-.17	2.1008	2.0978	.14
19	362	1.000	505.372	.612	35.60	35.71	-.31	2.2718	2.2657	.27
19	363	1.000	533.150	.612	35.60	35.72	-.36	2.4394	2.4315	.32
19	364	1.000	560.928	.612	35.60	35.71	-.33	2.6035	2.5957	.30
19	365	1.000	588.706	.612	35.60	35.68	-.24	2.7648	2.7586	.22
19	366	1.000	394.261	.689	40.05	39.86	.47	1.7058	1.7114	-.33
19	367	1.000	422.039	.689	40.05	39.92	.32	1.9161	1.9207	-.24
19	368	1.000	449.817	.689	40.05	39.98	.16	2.1194	2.1222	-.13
19	369	1.000	477.594	.689	40.05	40.05	-.01	2.3187	2.3184	.01
19	370	1.000	505.372	.689	40.05	40.08	-.09	2.5131	2.5111	.08
19	371	1.000	533.150	.689	40.05	40.15	-.27	2.7076	2.7011	.24
19	372	1.000	560.928	.689	40.05	40.15	-.26	2.8958	2.8891	.23
19	373	1.000	588.706	.689	40.05	40.14	-.23	3.0820	3.0754	.21
19	374	1.000	394.261	.787	45.77	45.69	.17	1.8712	1.8733	-.11
19	375	1.000	422.039	.787	45.77	45.58	.42	2.1153	2.1218	-.31
19	376	1.000	449.817	.787	45.77	45.58	.40	2.3518	2.3592	-.31
19	377	1.000	477.594	.787	45.77	45.68	.20	2.5855	2.5897	-.16
19	378	1.000	505.372	.787	45.77	45.79	-.04	2.8165	2.8155	.04
19	379	1.000	533.150	.787	45.77	45.88	-.24	3.0440	3.0376	.21

Table 7. (Continued)

Data sources and ID numbers: (1)Virial Equation, (3)Beattie, (19)Kay, (25)Olds, (29)Sage, (XXXX)Haynes.

ID	Data Point No.	Weight	Temp. K	Density expt mol/L	Density expt kg/m^3	Density calc kg/m^3	Density Diff. %	P_{expt} MPa	P_{calc} MPa	Pressure Diff. %
19	380	1.000	560.928	.787	45.77	45.94	-.38	3.2681	3.2571	.34
19	381	1.000	588.706	.787	45.77	45.97	-.45	3.4887	3.4745	.41
19	382	1.000	394.261	.919	53.39	53.17	.43	2.0546	2.0597	-.25
19	383	1.000	422.039	.919	53.39	53.08	.60	2.3546	2.3641	-.40
19	384	1.000	449.817	.919	53.39	53.29	.20	2.6483	2.6522	-.15
19	385	1.000	477.594	.919	53.39	53.39	.01	2.9303	2.9305	-.01
19	386	1.000	505.372	.919	53.39	53.40	-.01	3.2026	3.2023	.01
19	387	1.000	533.150	.919	53.39	53.39	.01	3.4688	3.4692	-.01
19	388	1.000	560.928	.919	53.39	53.24	.28	3.7232	3.7324	-.25
19	389	1.000	588.706	.919	53.39	53.13	.50	3.9748	3.9928	-.45
19	390	1.000	394.261	1.002	58.25	58.36	-.19	2.1636	2.1614	.10
19	391	1.000	422.039	1.002	58.25	57.80	.78	2.4911	2.5036	-.50
19	392	1.000	449.817	1.002	58.25	57.81	.75	2.8103	2.8254	-.54
19	393	1.000	477.594	1.002	58.25	57.97	.47	3.1240	3.1354	-.36
19	394	1.000	505.372	1.002	58.25	58.02	.39	3.4267	3.4375	-.32
19	395	1.000	533.150	1.002	58.25	58.05	.34	3.7232	3.7339	-.29
19	396	1.000	560.928	1.002	58.25	58.11	.24	4.0176	4.0260	-.21
19	397	1.000	588.706	1.002	58.25	58.11	.23	4.3058	4.3147	-.21
19	398	1.000	422.039	1.102	64.07	63.52	.86	2.6428	2.6567	-.52
19	399	1.000	449.817	1.102	64.07	63.53	.85	3.0027	3.0204	-.59
19	400	1.000	477.594	1.102	64.07	63.67	.63	3.3536	3.3695	-.47
19	401	1.000	505.372	1.102	64.07	63.85	.35	3.6990	3.7092	-.27
19	402	1.000	533.150	1.102	64.07	63.91	.26	4.0334	4.0420	-.21
19	403	1.000	560.928	1.102	64.07	63.87	.32	4.3575	4.3696	-.28
19	404	1.000	588.706	1.102	64.07	63.79	.45	4.6746	4.6932	-.39
19	405	1.000	422.039	1.225	71.19	70.41	1.10	2.8062	2.8235	-.61
19	406	1.000	449.817	1.225	71.19	70.55	.91	3.2212	3.2403	-.59
19	407	1.000	477.594	1.225	71.19	70.78	.58	3.6239	3.6391	-.42
19	408	1.000	505.372	1.225	71.19	70.89	.43	4.0127	4.0261	-.33
19	409	1.000	533.150	1.225	71.19	71.08	.17	4.3989	4.4047	-.13
19	410	1.000	560.928	1.225	71.19	71.09	.15	4.7712	4.7772	-.13
19	411	1.000	588.706	1.225	71.19	70.95	.34	5.1297	5.1448	-.29
19	412	1.000	422.039	1.378	80.09	79.01	1.35	2.9827	3.0028	-.67
19	413	1.000	449.817	1.378	80.09	79.31	.98	3.4681	3.4889	-.60
19	414	1.000	477.594	1.378	80.09	79.61	.60	3.9355	3.9518	-.41
19	415	1.000	505.372	1.378	80.09	79.64	.57	4.3816	4.4002	-.42
19	416	1.000	533.150	1.378	80.09	79.77	.41	4.8229	4.8384	-.32
19	417	1.000	560.928	1.378	80.09	79.81	.35	5.2538	5.2690	-.29
19	418	1.000	588.706	1.378	80.09	79.89	.25	5.6813	5.6937	-.22
19	419	1.000	422.039	1.450	84.31	83.57	.87	3.0647	3.0772	-.41
19	420	1.000	449.817	1.450	84.31	83.70	.72	3.5818	3.5971	-.42
19	421	1.000	477.594	1.450	84.31	83.87	.52	4.0769	4.0912	-.35
19	422	1.000	505.372	1.450	84.31	83.83	.57	4.5505	4.5694	-.41
19	423	1.000	533.150	1.450	84.31	83.86	.53	5.0159	5.0366	-.41
19	424	1.000	560.928	1.450	84.31	83.98	.39	5.4779	5.4955	-.32
19	425	1.000	588.706	1.450	84.31	84.06	.30	5.9329	5.9480	-.25
19	426	1.000	422.039	1.531	88.99	88.00	1.12	3.1371	3.1524	-.49
19	427	1.000	449.817	1.531	88.99	88.21	.87	3.6921	3.7105	-.50
19	428	1.000	477.594	1.531	88.99	88.45	.61	4.2230	4.2399	-.40
19	429	1.000	505.372	1.531	88.99	88.51	.54	4.7333	4.7518	-.39
19	430	1.000	533.150	1.531	88.99	88.66	.37	5.2366	5.2517	-.29
19	431	1.000	560.928	1.531	88.99	88.68	.35	5.7261	5.7426	-.29
19	432	1.000	588.706	1.531	88.99	88.75	.28	6.2122	6.2266	-.23
19	433	1.000	422.039	1.621	94.23	93.14	1.15	3.2130	3.2278	-.46
19	434	1.000	449.817	1.621	94.23	93.48	.80	3.8128	3.8293	-.43
19	435	1.000	477.594	1.621	94.23	93.77	.49	4.3851	4.3987	-.31

Table 7. (Continued)

Data sources and ID numbers: (1)Virial Equation, (3)Beattie, (19)Kay, (25)Olds, (29)Sage, (XXXX)Haynes.

ID	Data Point No.	Weight	Temp. K	Density expt mol/L	Density expt kg/m^3	Density calc kg/m^3	Density Diff. %	P_{expt} MPa	P_{calc} MPa	Pressure Diff. %
19	436	1.000	505.372	1.621	94.23	93.80	.45	4.9332	4.9490	-.32
19	437	1.000	533.150	1.621	94.23	93.96	.28	5.4744	5.4861	-.21
19	438	1.000	560.928	1.621	94.23	93.93	.31	5.9984	6.0135	-.25
19	439	1.000	588.706	1.621	94.23	93.86	.39	6.5121	6.5335	-.33
19	440	1.000	422.039	1.722	100.12	98.87	1.25	3.2874	3.3023	-.45
19	441	1.000	449.817	1.722	100.12	99.64	.48	3.9438	3.9535	-.24
19	442	1.000	477.594	1.722	100.12	99.60	.52	4.5540	4.5686	-.32
19	443	1.000	505.372	1.722	100.12	99.77	.35	5.1504	5.1628	-.24
19	444	1.000	533.150	1.722	100.12	99.81	.31	5.7295	5.7427	-.23
19	445	1.000	560.928	1.722	100.12	99.98	.14	6.3053	6.3121	-.11
19	446	1.000	588.706	1.722	100.12	100.01	.11	6.8672	6.8734	-.09
19	447	1.000	422.039	1.837	106.79	105.13	1.56	3.3577	3.3746	-.50
19	448	1.000	449.817	1.837	106.79	105.98	.76	4.0679	4.0830	-.37
19	449	1.000	477.594	1.837	106.79	106.26	.50	4.7367	4.7509	-.30
19	450	1.000	505.372	1.837	106.79	106.37	.40	5.3814	5.3958	-.27
19	451	1.000	533.150	1.837	106.79	106.48	.29	6.0122	6.0252	-.22
19	452	1.000	560.928	1.837	106.79	106.58	.20	6.6328	6.6433	-.16
19	453	1.000	588.706	1.837	106.79	106.68	.10	7.2464	7.2526	-.09
19	454	1.000	422.039	1.968	114.42	112.45	1.72	3.4267	3.4430	-.47
19	455	1.000	449.817	1.968	114.42	113.71	.62	4.2058	4.2177	-.28
19	456	1.000	477.594	1.968	114.42	113.73	.60	4.9298	4.9468	-.34
19	457	1.000	505.372	1.968	114.42	114.08	.30	5.6399	5.6510	-.20
19	458	1.000	533.150	1.968	114.42	114.20	.19	6.3294	6.3384	-.14
19	459	1.000	560.928	1.968	114.42	114.31	.09	7.0085	7.0135	-.07
19	460	1.000	588.706	1.968	114.42	114.45	-.03	7.6808	7.6792	.02
19	461	1.000	422.039	2.120	123.22	121.72	1.21	3.4956	3.5050	-.27
19	462	1.000	449.817	2.120	123.22	122.55	.55	4.3471	4.3572	-.23
19	463	1.000	477.594	2.120	123.22	122.73	.40	5.1469	5.1583	-.22
19	464	1.000	505.372	2.120	123.22	122.80	.34	5.9191	5.9323	-.22
19	465	1.000	533.150	2.120	123.22	123.21	.01	6.6879	6.6884	-.01
19	466	1.000	560.928	2.120	123.22	123.46	-.20	7.4429	7.4314	.15
19	467	1.000	588.706	2.120	123.22	123.77	-.45	8.1944	8.1642	.37
19	468	1.000	422.039	2.297	133.49	131.89	1.20	3.5508	3.5578	-.20
19	469	1.000	449.817	2.297	133.49	132.25	.92	4.4850	4.5014	-.36
19	470	1.000	477.594	2.297	133.49	133.03	.34	5.3779	5.3878	-.18
19	471	1.000	505.372	2.297	133.49	133.41	.06	6.2432	6.2455	-.04
19	472	1.000	533.150	2.297	133.49	133.76	-.21	7.0947	7.0842	.15
19	473	1.000	560.928	2.297	133.49	133.92	-.32	7.9290	7.9091	.25
19	474	1.000	436.428	2.505	145.62	143.07	1.75	4.1369	4.1557	-.45
19	475	1.000	455.150	2.505	145.62	144.35	.88	4.8263	4.8431	-.35
19	476	1.000	474.428	2.505	145.62	144.97	.45	5.5158	5.5283	-.23
19	477	1.000	494.094	2.505	145.62	145.35	.19	6.2053	6.2120	-.11
19	478	1.000	513.983	2.505	145.62	145.71	-.06	6.8948	6.8921	.04
19	479	1.000	533.983	2.505	145.62	146.09	-.32	7.5842	7.5669	.23
19	480	1.000	554.150	2.505	145.62	146.40	-.53	8.2737	8.2400	.41
19	481	1.000	434.317	2.756	160.18	155.84	2.71	4.1369	4.1592	-.54
19	482	1.000	450.817	2.756	160.18	158.39	1.12	4.8263	4.8446	-.38
19	483	1.000	467.706	2.756	160.18	159.49	.43	5.5158	5.5265	-.19
19	484	1.000	484.983	2.756	160.18	159.91	.17	6.2053	6.2110	-.09
19	485	1.000	502.594	2.756	160.18	160.04	.09	6.8948	6.8986	-.06
19	486	1.000	519.817	2.756	160.18	160.83	-.40	7.5842	7.5634	.28
19	487	1.000	537.039	2.756	160.18	161.55	-.85	8.2737	8.2220	.63
19	488	1.000	432.650	3.062	177.98	172.67	2.99	4.1369	4.1542	-.42
19	489	1.000	447.039	3.062	177.98	176.67	.74	4.8263	4.8365	-.21
19	490	1.000	461.983	3.062	177.98	176.91	.61	5.5158	5.5294	-.25
19	491	1.000	476.983	3.062	177.98	177.44	.30	6.2053	6.2148	-.15

Table 7. (Continued)

Data sources and ID numbers: (1)Virial Equation, (3)Beattie, (19)Kay, (25)Olds, (29)Sage, (XXXX)Haynes.

ID	Data Point No.	Weight	Temp. K	Density expt mol/L	Density expt kg/m^3	Density calc kg/m^3	Density Diff. %	P_{expt} MPa	P_{calc} MPa	Pressure Diff. %
19	492	1.000	491.983	3.062	177.98	178.07	-.05	6.8948	6.8928	.03
19	493	1.000	507.039	3.062	177.98	178.59	-.34	7.5842	7.5674	.22
19	494	1.000	522.317	3.062	177.98	178.79	-.45	8.2737	8.2469	.33
19	495	1.000	431.150	3.445	200.23	203.58	-1.67	4.1369	4.1306	.15
19	496	1.000	444.094	3.445	200.23	198.09	1.07	4.8263	4.8395	-.27
19	497	1.000	456.928	3.445	200.23	198.59	.82	5.5158	5.5332	-.31
19	498	1.000	469.594	3.445	200.23	199.76	.23	6.2053	6.2123	-.11
19	499	1.000	482.261	3.445	200.23	200.60	-.19	6.8948	6.8874	.11
19	500	1.000	494.983	3.445	200.23	201.14	-.45	7.5842	7.5620	.29
19	501	1.000	507.706	3.445	200.23	201.59	-.68	8.2737	8.2336	.49
19	502	1.000	430.761	3.675	213.58	216.60	-1.41	4.1369	4.1318	.12
19	503	1.000	443.039	3.675	213.58	207.90	2.66	4.8263	4.8593	-.68
19	504	1.000	454.650	3.675	213.58	210.90	1.26	5.5158	5.5427	-.49
19	505	1.000	466.261	3.675	213.58	212.33	.58	6.2053	6.2233	-.29
19	506	1.000	477.706	3.675	213.58	213.73	-.07	6.8948	6.8918	.04
19	507	1.000	489.261	3.675	213.58	214.40	-.38	7.5842	7.5650	.25
19	508	1.000	500.928	3.675	213.58	214.67	-.51	8.2737	8.2428	.37
19	509	1.000	441.650	3.937	228.84	222.59	2.73	4.8263	4.8614	-.72
19	510	1.000	452.150	3.937	228.84	226.35	1.09	5.5158	5.5400	-.44
19	511	1.000	462.983	3.937	228.84	226.37	1.08	6.2053	6.2401	-.56
19	512	1.000	473.539	3.937	228.84	227.37	.64	6.8948	6.9220	-.39
19	513	1.000	483.928	3.937	228.84	228.47	.16	7.5842	7.5927	-.11
19	514	1.000	494.428	3.937	228.84	228.96	-.05	8.2737	8.2703	.04
19	515	1.000	438.372	4.593	266.97	263.49	1.30	4.8263	4.8481	-.45
19	516	1.000	446.928	4.593	266.97	264.55	.91	5.5158	5.5411	-.46
19	517	1.000	455.428	4.593	266.97	264.94	.76	6.2053	6.2352	-.48
19	518	1.000	463.872	4.593	266.97	265.20	.67	6.8948	6.9287	-.49
19	519	1.000	472.428	4.593	266.97	264.85	.80	7.5842	7.6343	-.66
19	520	1.000	480.817	4.593	266.97	265.02	.73	8.2737	8.3286	-.66
19	521	1.000	433.039	5.512	320.37	318.41	.61	4.8263	4.8554	-.60
19	522	1.000	439.150	5.512	320.37	318.99	.43	5.5158	5.5428	-.49
19	523	1.000	445.206	5.512	320.37	319.28	.34	6.2053	6.2317	-.42
19	524	1.000	451.261	5.512	320.37	319.27	.34	6.8948	6.9267	-.46
19	525	1.000	457.428	5.512	320.37	318.73	.51	7.5842	7.6394	-.72
19	526	1.000	463.261	5.512	320.37	319.23	.36	8.2737	8.3175	-.53
19	527	1.000	417.039	6.124	355.97	354.19	.50	3.4474	3.4821	-1.00
19	528	1.000	426.983	6.124	355.97	354.30	.47	4.8263	4.8769	-1.04
19	529	1.000	431.594	6.124	355.97	355.41	.16	5.5158	5.5356	-.36
19	530	1.000	436.428	6.124	355.97	355.31	.18	6.2053	6.2320	-.43
19	531	1.000	440.928	6.124	355.97	356.18	-.06	6.8948	6.8850	.14
19	532	1.000	445.872	6.124	355.97	355.52	.13	7.5842	7.6068	-.30
19	533	1.000	450.428	6.124	355.97	355.94	.01	8.2737	8.2753	-.02
19	534	1.000	413.706	6.484	376.91	373.78	.83	3.4474	3.5525	-2.96
19	535	1.000	422.039	6.484	376.91	374.93	.52	4.8263	4.9150	-1.80
19	536	1.000	425.928	6.484	376.91	376.05	.23	5.5158	5.5587	-.77
19	537	1.000	429.872	6.484	376.91	376.72	.05	6.2053	6.2156	-.17
19	538	1.000	433.928	6.484	376.91	376.91	0.00	6.8948	6.8948	-.00
19	539	1.000	438.039	6.484	376.91	376.87	.01	7.5842	7.5866	-.03
19	540	1.000	442.039	6.484	376.91	377.06	-.04	8.2737	8.2626	.13
19	541	1.000	403.261	6.890	400.46	401.24	-.20	2.7579	2.7173	1.49
19	542	1.000	407.039	6.890	400.46	400.53	-.02	3.4474	3.4436	.11
19	543	1.000	414.317	6.890	400.46	400.01	.11	4.8263	4.8573	-.64
19	544	1.000	418.150	6.890	400.46	399.20	.32	5.5158	5.6082	-1.65
19	545	1.000	421.539	6.890	400.46	399.57	.22	6.2053	6.2750	-1.11
19	546	1.000	424.928	6.890	400.46	399.87	.15	6.8948	6.9443	-.71
19	547	1.000	428.206	6.890	400.46	400.35	.03	7.5842	7.5939	-.13

Table 7. (Continued)

Data sources and ID numbers: (1)Virial Equation, (3)Beattie, (19)Kay, (25)Olds, (29)Sage, (XXXX)Haynes.

ID	Data Point No.	Weight	Temp. K	Density expt mol/L	Density expt kg/m^3	Density calc kg/m^3	Density Diff. %	P_{expt} MPa	P_{calc} MPa	Pressure Diff. %
19	548	1.000	431.483	6.890	400.46	400.76	-.08	8.2737	8.2454	.34
19	549	1.000	394.817	7.349	427.16	427.37	-.05	2.7579	2.7394	.67
19	550	1.000	397.761	7.349	427.16	427.32	-.04	3.4474	3.4321	.45
19	551	1.000	403.706	7.349	427.16	427.05	.03	4.8263	4.8376	-.23
19	552	1.000	406.817	7.349	427.16	426.60	.13	5.5158	5.5765	-1.09
19	553	1.000	409.872	7.349	427.16	426.29	.20	6.2053	6.3042	-1.57
19	554	1.000	413.039	7.349	427.16	425.77	.33	6.8948	7.0601	-2.34
19	555	1.000	415.928	7.349	427.16	425.81	.31	7.5842	7.7513	-2.16
19	556	1.000	419.094	7.349	427.16	425.33	.43	8.2737	8.5104	-2.78
19	557	1.000	388.817	7.602	441.89	442.26	-.08	2.7579	2.7161	1.54
19	558	1.000	391.483	7.602	441.89	442.15	-.06	3.4474	3.4160	.92
19	559	1.000	396.539	7.602	441.89	442.50	-.14	4.8263	4.7474	1.66
19	560	1.000	399.261	7.602	441.89	442.26	-.08	5.5158	5.4664	.90
19	561	1.000	401.817	7.602	441.89	442.34	-.10	6.2053	6.1425	1.02
19	562	1.000	404.261	7.602	441.89	442.61	-.16	6.8948	6.7903	1.54
19	563	1.000	407.150	7.602	441.89	442.07	-.04	7.5842	7.5570	.36
19	564	1.000	410.872	7.602	441.89	440.12	.40	8.2737	8.5466	-3.19
19	565	1.000	381.872	7.874	457.67	457.33	.07	2.7579	2.8068	-1.74
19	566	1.000	384.094	7.874	457.67	457.57	.02	3.4474	3.4621	-.43
19	567	1.000	388.706	7.874	457.67	457.68	-.00	4.8263	4.8245	.04
19	568	1.000	390.928	7.874	457.67	457.87	-.04	5.5158	5.4822	.61
19	569	1.000	392.872	7.874	457.67	458.53	-.19	6.2053	6.0583	2.43
19	570	1.000	395.206	7.874	457.67	458.49	-.18	6.8948	6.7502	2.14
19	571	1.000	397.761	7.874	457.67	458.09	-.09	7.5842	7.5087	1.01
19	572	1.000	401.150	7.874	457.67	456.36	.29	8.2737	8.5157	-2.84
19	573	1.000	373.150	8.166	474.62	474.07	.12	2.7579	2.8592	-3.54
19	574	1.000	375.261	8.166	474.62	474.01	.13	3.4474	3.5636	-3.26
19	575	1.000	378.928	8.166	474.62	474.81	-.04	4.8263	4.7881	.80
19	576	1.000	380.928	8.166	474.62	474.91	-.06	5.5158	5.4565	1.09
19	577	1.000	382.594	8.166	474.62	475.53	-.19	6.2053	6.0138	3.18
19	578	1.000	384.817	8.166	474.62	475.26	-.13	6.8948	6.7572	2.04
19	579	1.000	387.150	8.166	474.62	474.83	-.04	7.5842	7.5381	.61
19	580	1.000	390.317	8.166	474.62	473.17	.30	8.2737	8.5985	-3.78
19	581	1.000	367.594	8.480	492.88	492.81	.01	4.8263	4.8427	-.34
19	582	1.000	369.261	8.480	492.88	493.03	-.03	5.5158	5.4770	.71
19	583	1.000	370.928	8.480	492.88	493.24	-.07	6.2053	6.1114	1.54
19	584	1.000	372.594	8.480	492.88	493.44	-.11	6.8948	6.7458	2.21
19	585	1.000	374.594	8.480	492.88	493.16	-.06	7.5842	7.5072	1.03
19	586	1.000	377.039	8.480	492.88	492.28	.12	8.2737	8.4377	-1.94
19	587	1.000	349.483	8.819	512.59	512.16	.08	2.7579	2.8876	-4.49
19	588	1.000	351.039	8.819	512.59	512.20	.08	3.4474	3.5684	-3.39
19	589	1.000	353.706	8.819	512.59	512.88	-.06	4.8263	4.7353	1.92
19	590	1.000	355.094	8.819	512.59	513.13	-.10	5.5158	5.3428	3.24
19	591	1.000	356.483	8.819	512.59	513.37	-.15	6.2053	5.9502	4.29
19	592	1.000	359.594	8.819	512.59	513.41	-.16	7.5842	7.3103	3.75
19	593	1.000	361.650	8.819	512.59	512.78	-.04	8.2737	8.2086	.79

Table 7. (Continued)

Data sources and ID numbers: (1)Virial Equation, (3)Beattie, (19)Kay, (25)Olds, (29)Sage, (XXXX)Haynes.

ID	Data Point No.	Weight	Temp. K	Density expt mol/L	Density expt kg/m^3	Density calc kg/m^3	Density Diff. %	P_{expt} MPa	P_{calc} MPa	Pressure Diff. %
4302	594	1.000	140.000	12.809	744.53	743.88	.09	31.2779	32.8854	-4.89
4303	595	1.000	140.000	12.784	743.04	742.49	.07	27.8345	29.1743	-4.59
4304	596	1.000	140.000	12.758	741.56	741.08	.06	24.3914	25.5359	-4.48
4305	597	1.000	140.000	12.733	740.07	739.65	.06	20.9481	21.9549	-4.59
4306	598	1.000	140.000	12.707	738.59	738.20	.05	17.5051	18.4307	-5.02
4307	599	1.000	140.000	12.681	737.08	736.72	.05	14.0619	14.8951	-5.59
4308	600	1.000	140.000	12.655	735.54	735.22	.04	10.6191	11.3508	-6.45
4309	601	1.000	140.000	12.628	733.98	733.69	.04	7.1760	7.8265	-8.31
4310	602	1.000	140.000	12.601	732.44	732.14	.04	3.7333	4.4005	-15.16
3601	603	1.000	160.000	12.548	729.37	729.01	.05	36.0986	36.9184	-2.22
3602	604	1.000	160.000	12.516	727.45	727.18	.04	31.9664	32.5829	-1.89
3603	605	1.000	160.000	12.483	725.55	725.31	.03	27.8343	28.3496	-1.82
3604	606	1.000	160.000	12.454	723.90	723.73	.02	24.3911	24.7550	-1.47
3605	607	1.000	160.000	12.426	722.25	722.12	.02	20.9479	21.2376	-1.36
3606	608	1.000	160.000	12.397	720.58	720.47	.01	17.5048	17.7234	-1.23
3607	609	1.000	160.000	12.368	718.90	718.80	.01	14.0617	14.2744	-1.49
3608	610	1.000	160.000	12.345	717.55	717.44	.02	11.3074	11.5312	-1.94
3609	611	1.000	160.000	12.322	716.19	716.06	.02	8.5529	8.8182	-3.01
3610	612	1.000	160.000	12.298	714.83	714.65	.02	5.7987	6.1467	-5.66
3611	613	1.000	160.000	12.281	713.81	713.58	.03	3.7330	4.1760	-10.61
3612	614	1.000	160.000	12.263	712.77	712.50	.04	1.6672	2.1727	-23.27
3701	615	1.000	180.000	12.263	712.75	712.48	.04	36.0984	36.6620	-1.54
3702	616	1.000	180.000	12.226	710.65	710.44	.03	31.9664	32.3878	-1.30
3703	617	1.000	180.000	12.189	708.47	708.35	.02	27.8343	28.0762	-.86
3704	618	1.000	180.000	12.157	706.62	706.57	.01	24.3911	24.4925	-.41
3705	619	1.000	180.000	12.125	704.77	704.76	.00	20.9478	20.9834	-.17
3706	620	1.000	180.000	12.093	702.90	702.90	0.00	17.5047	17.5051	-.00
3707	621	1.000	180.000	12.061	701.03	701.01	.00	14.0616	14.1012	-.28
3708	622	1.000	180.000	12.034	699.49	699.46	.00	11.3073	11.3552	-.42
3709	623	1.000	180.000	12.008	697.93	697.89	.01	8.5528	8.6180	-.76
3710	624	1.000	180.000	11.980	696.33	696.29	.01	5.7986	5.8816	-1.41
3711	625	1.000	180.000	11.961	695.20	695.06	.02	3.7329	3.9557	-5.63
3712	626	1.000	180.000	11.940	694.01	693.82	.03	1.6671	1.9791	-15.76
3801	627	1.000	200.000	11.981	696.38	696.14	.03	36.0981	36.5395	-1.21
3802	628	1.000	200.000	11.940	694.00	693.86	.02	31.9662	32.2189	-.78
3803	629	1.000	200.000	11.899	691.63	691.53	.01	27.8341	28.0144	-.64
3804	630	1.000	200.000	11.864	689.58	689.54	.01	24.3910	24.4689	-.32
3805	631	1.000	200.000	11.828	687.48	687.49	-.00	20.9477	20.9206	.13
3806	632	1.000	200.000	11.792	685.38	685.40	-.00	17.5047	17.4691	.20
3807	633	1.000	200.000	11.755	683.25	683.25	-.00	14.0616	14.0573	.03
3808	634	1.000	200.000	11.725	681.50	681.50	0.00	11.3073	11.3074	-.00
3809	635	1.000	200.000	11.694	679.71	679.70	.00	8.5528	8.5718	-.22
3810	636	1.000	200.000	11.663	677.89	677.86	.00	5.7986	5.8354	-.63
3811	637	1.000	200.000	11.639	676.50	676.46	.01	3.7329	3.7939	-1.61
3812	638	1.000	200.000	11.615	675.10	675.02	.01	1.6671	1.7793	-6.31
3901	639	1.000	220.000	11.701	680.11	679.94	.02	36.0987	36.3776	-.77
3902	640	1.000	220.000	11.655	677.44	677.40	.01	31.9668	32.0217	-.17
3903	641	1.000	220.000	11.608	674.72	674.79	-.01	27.8346	27.7285	.38
3904	642	1.000	220.000	11.569	672.44	672.55	-.02	24.3914	24.2220	.70
3905	643	1.000	220.000	11.530	670.15	670.25	-.01	20.9481	20.8026	.70
3906	644	1.000	220.000	11.489	667.77	667.88	-.02	17.5050	17.3531	.88
3907	645	1.000	220.000	11.446	665.30	665.44	-.02	14.0618	13.8668	1.41
3908	646	1.000	220.000	11.410	663.20	663.43	-.03	11.3076	10.9962	2.83
3909	647	1.000	220.000	11.374	661.11	661.37	-.04	8.5530	8.2088	4.19
3910	648	1.000	220.000	11.338	658.98	659.25	-.04	5.7987	5.4583	6.24

Table 7. (Continued)

Data sources and ID numbers: (1)Virial Equation, (3)Beattie, (19)Kay, (25)Olds, (29)Sage, (XXXX)Haynes.

ID	Data Point No.	Weight	Temp. K	Density expt mol/L	Density expt kg/m^3	Density calc kg/m^3	Density Diff. %	P_{expt} MPa	P_{calc} MPa	Pressure Diff. %
3911	649	1.000	220.000	11.310	657.39	657.62	-.04	3.7331	3.4357	8.66
3912	650	1.000	220.000	11.283	655.79	655.96	-.03	1.6672	1.4551	14.57
4001	651	1.000	240.000	11.424	663.98	663.83	.02	36.0977	36.3296	-.64
4002	652	1.000	240.000	11.372	661.00	661.00	.00	31.9657	31.9687	-.01
4003	653	1.000	240.000	11.320	657.98	658.07	-.01	27.8336	27.7063	.46
4004	654	1.000	240.000	11.275	655.36	655.55	-.03	24.3909	24.1434	1.03
4005	655	1.000	240.000	11.229	652.66	652.94	-.04	20.9473	20.5820	1.77
4006	656	1.000	240.000	11.181	649.91	650.25	-.05	17.5042	17.0823	2.47
4007	657	1.000	240.000	11.133	647.07	647.46	-.06	14.0611	13.5989	3.40
4008	658	1.000	240.000	11.092	644.74	645.15	-.06	11.3069	10.8248	4.45
4009	659	1.000	240.000	11.051	642.31	642.77	-.07	8.5522	8.0299	6.50
4010	660	1.000	240.000	11.008	639.86	640.31	-.07	5.7980	5.2994	9.41
4011	661	1.000	240.000	10.976	638.00	638.41	-.06	3.7324	3.2889	13.49
4012	662	1.000	240.000	10.945	636.18	636.46	-.04	1.6665	1.3777	20.96
4101	663	1.000	260.000	11.149	648.02	647.76	.04	36.0979	36.4519	-.97
4102	664	1.000	260.000	11.092	644.71	644.60	.02	31.9659	32.1117	-.45
4103	665	1.000	260.000	11.033	641.31	641.30	.00	27.8339	27.8391	-.02
4104	666	1.000	260.000	10.983	638.39	638.45	-.01	24.3908	24.3161	.31
4105	667	1.000	260.000	10.931	635.35	635.49	-.02	20.9475	20.7769	.82
4106	668	1.000	260.000	10.876	632.17	632.42	-.04	17.5045	17.2294	1.60
4107	669	1.000	260.000	10.819	628.84	629.21	-.06	14.0613	13.6707	2.86
4108	670	1.000	260.000	10.771	626.07	626.54	-.07	11.3071	10.8399	4.31
4109	671	1.000	260.000	10.723	623.27	623.76	-.08	8.5526	8.0753	5.91
4110	672	1.000	260.000	10.673	620.36	620.88	-.08	5.7984	5.3147	9.10
4111	673	1.000	260.000	10.635	618.17	618.64	-.08	3.7328	3.3116	12.72
4112	674	1.000	260.000	10.597	615.91	616.32	-.07	1.6669	1.3154	26.72
4201	675	1.000	280.000	10.846	630.43	630.52	-.01	34.7206	34.6103	.32
4202	676	1.000	280.000	10.794	627.38	627.54	-.02	31.2773	31.1014	.57
4203	677	1.000	280.000	10.739	624.17	624.44	-.04	27.8338	27.5496	1.03
4204	678	1.000	280.000	10.681	620.80	621.20	-.07	24.3907	23.9675	1.77
4205	679	1.000	280.000	10.620	617.26	617.83	-.09	20.9475	20.3804	2.78
4206	680	1.000	280.000	10.557	613.59	614.29	-.11	17.5045	16.8400	3.95
4207	681	1.000	280.000	10.491	609.80	610.58	-.13	14.0614	13.3646	5.21
4208	682	1.000	280.000	10.437	606.64	607.46	-.14	11.3071	10.6033	6.64
4209	683	1.000	280.000	10.381	603.39	604.19	-.13	8.5526	7.8982	8.29
4210	684	1.000	280.000	10.323	600.02	600.77	-.12	5.7984	5.2194	11.09
4211	685	1.000	280.000	10.279	597.45	598.08	-.11	3.7328	3.2624	14.42
4212	686	1.000	280.000	10.234	594.83	595.27	-.07	1.6669	1.3516	23.33
3501	687	1.000	300.000	10.573	614.53	614.27	.04	34.7208	34.9909	-.77
3502	688	1.000	300.000	10.514	611.11	610.92	.03	31.2774	31.4665	-.60
3503	689	1.000	300.000	10.452	607.49	607.41	.01	27.8340	27.9054	-.26
3504	690	1.000	300.000	10.386	603.65	603.73	-.01	24.3909	24.3144	.31
3505	691	1.000	300.000	10.316	599.58	599.86	-.05	20.9476	20.7038	1.18
3506	692	1.000	300.000	10.242	595.31	595.77	-.08	17.5045	17.1296	2.19
3507	693	1.000	300.000	10.166	590.90	591.44	-.09	14.0613	13.6494	3.02
3508	694	1.000	300.000	10.100	587.07	587.76	-.12	11.3071	10.8072	4.63
3509	695	1.000	300.000	10.031	583.02	583.87	-.14	8.5525	7.9763	7.22
3510	696	1.000	300.000	9.958	578.82	579.73	-.16	5.7983	5.2152	11.18
3511	697	1.000	300.000	9.904	575.64	576.44	-.14	3.7326	3.2438	15.07
3512	698	1.000	300.000	9.848	572.40	572.97	-.10	1.6667	1.3373	24.63

Table 7. (Continued)

Data sources and ID numbers: (1)Virial Equation, (3)Beattie, (19)Kay, (25)Olds, (29)Sage, (XXXX)Haynes.

ID	Data Point No.	Weight	Temp. K	Density expt mol/L	Density expt kg/m^3	Density calc kg/m^3	Density Diff. %	P_{expt} MPa	P_{calc} MPa	Pressure Diff. %
25	699	1.000	310.928	.027	1.58	1.58	-.07	.0689	.0689	.07
25	700	1.000	344.261	.024	1.42	1.42	-.18	.0689	.0688	.17
25	701	1.000	377.594	.022	1.29	1.29	-.23	.0689	.0688	.23
25	702	1.000	410.928	.020	1.18	1.18	-.25	.0689	.0688	.25
25	703	1.000	444.261	.019	1.09	1.09	-.26	.0689	.0688	.26
25	704	1.000	477.594	.017	1.01	1.02	-.27	.0689	.0688	.27
25	705	1.000	510.928	.016	.95	.95	-.25	.0689	.0688	.25
25	706	1.000	310.928	.040	2.34	2.34	.03	.1013	.1014	-.03
25	707	1.000	344.261	.036	2.10	2.10	-.13	.1013	.1012	.13
25	708	1.000	377.594	.033	1.90	1.91	-.22	.1013	.1011	.21
25	709	1.000	410.928	.030	1.74	1.75	-.27	.1013	.1011	.27
25	710	1.000	444.261	.028	1.61	1.61	-.30	.1013	.1010	.30
25	711	1.000	477.594	.026	1.49	1.50	-.30	.1013	.1010	.30
25	712	1.000	510.928	.024	1.39	1.40	-.29	.1013	.1010	.29
25	713	1.000	310.928	.055	3.22	3.22	.14	.1379	.1381	-.13
25	714	1.000	344.261	.050	2.88	2.88	-.06	.1379	.1378	.06
25	715	1.000	377.594	.045	2.60	2.61	-.18	.1379	.1376	.18
25	716	1.000	410.928	.041	2.38	2.39	-.26	.1379	.1375	.26
25	717	1.000	444.261	.038	2.19	2.20	-.31	.1379	.1375	.31
25	718	1.000	477.594	.035	2.04	2.04	-.34	.1379	.1374	.33
25	719	1.000	510.928	.033	1.90	1.91	-.32	.1379	.1375	.32
25	720	1.000	310.928	.085	4.94	4.92	.32	.2068	.2075	-.30
25	721	1.000	344.261	.075	4.38	4.38	.08	.2068	.2070	-.08
25	722	1.000	377.594	.068	3.95	3.95	-.11	.2068	.2066	.10
25	723	1.000	410.928	.062	3.60	3.61	-.22	.2068	.2064	.22
25	724	1.000	444.261	.057	3.31	3.32	-.32	.2068	.2062	.32
25	725	1.000	477.594	.053	3.05	3.08	-.75	.2068	.2053	.74
25	726	1.000	510.928	.049	2.86	2.87	-.36	.2068	.2061	.36
25	727	1.000	310.928	.116	6.72	6.69	.42	.2758	.2769	-.39
25	728	1.000	344.261	.102	5.93	5.91	.20	.2758	.2763	-.19
25	729	1.000	377.594	.092	5.32	5.32	.00	.2758	.2758	-.00
25	730	1.000	410.928	.083	4.84	4.84	-.19	.2758	.2753	.18
25	731	1.000	444.261	.076	4.44	4.45	-.30	.2758	.2750	.29
25	732	1.000	477.594	.071	4.11	4.12	-.37	.2758	.2748	.36
25	733	1.000	510.928	.066	3.82	3.84	-.38	.2758	.2748	.38
25	734	1.000	344.261	.158	9.16	9.13	.35	.4137	.4150	-.32
25	735	1.000	377.594	.140	8.16	8.14	.18	.4137	.4144	-.16
25	736	1.000	410.928	.127	7.37	7.37	-.07	.4137	.4134	.07
25	737	1.000	444.261	.116	6.74	6.75	-.26	.4137	.4126	.25
25	738	1.000	477.594	.107	6.21	6.24	-.37	.4137	.4122	.36
25	739	1.000	510.928	.099	5.77	5.80	-.41	.4137	.4120	.40
25	740	1.000	344.261	.281	16.31	16.29	.12	.6895	.6901	-.10
25	741	1.000	377.594	.245	14.24	14.18	.43	.6895	.6921	-.38
25	742	1.000	410.928	.218	12.70	12.68	.14	.6895	.6903	-.13
25	743	1.000	444.261	.198	11.50	11.52	-.17	.6895	.6884	.16
25	744	1.000	477.594	.181	10.55	10.58	-.33	.6895	.6873	.31
25	745	1.000	510.928	.168	9.76	9.80	-.38	.6895	.6870	.37
25	746	1.000	377.594	.393	22.82	22.71	.50	1.0342	1.0385	-.41
25	747	1.000	410.928	.343	19.93	19.86	.36	1.0342	1.0375	-.31
25	748	1.000	444.261	.306	17.81	17.82	-.03	1.0342	1.0339	.03
25	749	1.000	477.594	.279	16.19	16.24	-.27	1.0342	1.0316	.25
25	750	1.000	510.928	.256	14.91	14.96	-.35	1.0342	1.0308	.33
25	751	1.000	377.594	.566	32.93	32.88	.14	1.3790	1.3803	-.10
25	752	1.000	410.928	.481	27.96	27.80	.56	1.3790	1.3854	-.46
25	753	1.000	444.261	.423	24.58	24.56	.07	1.3790	1.3798	-.06

Table 7. (Continued)

Data sources and ID numbers: (1)Virial Equation, (3)Beattie, (19)Kay, (25)Olds, (29)Sage, (XXXX)Haynes.

ID	Data Point No.	Weight	Temp. K	Density expt mol/L	Density expt kg/m^3	Density calc kg/m^3	Density Diff. %	P_{expt} MPa	P_{calc} MPa	Pressure Diff. %
25	754	1.000	477.594	.381	22.14	22.18	-.17	1.3790	1.3768	.16
25	755	1.000	510.928	.348	20.24	20.30	-.30	1.3790	1.3751	.28
25	756	1.000	310.928	9.639	560.28	560.20	.01	1.7237	1.7638	-2.27
25	757	1.000	344.261	8.887	516.56	516.36	.04	1.7237	1.7845	-3.41
25	758	1.000	377.594	7.908	459.64	458.95	.15	1.7237	1.8207	-5.33
25	759	1.000	410.928	.637	37.04	36.77	.72	1.7237	1.7332	-.55
25	760	1.000	444.261	.549	31.88	31.82	.21	1.7237	1.7267	-.17
25	761	1.000	477.594	.489	28.40	28.42	-.07	1.7237	1.7226	.06
25	762	1.000	510.928	.444	25.79	25.85	-.24	1.7237	1.7200	.22
25	763	1.000	310.928	9.653	561.07	560.88	.03	2.0684	2.1654	-4.48
25	764	1.000	344.261	8.907	517.73	517.47	.05	2.0684	2.1509	-3.83
25	765	1.000	377.594	7.947	461.89	461.35	.12	2.0684	2.1487	-3.73
25	766	1.000	410.928	.819	47.60	47.22	.81	2.0684	2.0800	-.56
25	767	1.000	444.261	.686	39.85	39.71	.34	2.0684	2.0741	-.27
25	768	1.000	477.594	.603	35.04	35.02	.08	2.0684	2.0698	-.07
25	769	1.000	510.928	.543	31.56	31.61	-.18	2.0684	2.0651	.16
25	770	1.000	310.928	9.677	562.45	562.21	.04	2.7579	2.8839	-4.37
25	771	1.000	344.261	8.948	520.08	519.61	.09	2.7579	2.9137	-5.35
25	772	1.000	377.594	8.023	466.33	465.79	.12	2.7579	2.8459	-3.09
25	773	1.000	410.928	1.336	77.67	77.52	.19	2.7579	2.7602	-.08
25	774	1.000	444.261	1.006	58.46	58.12	.58	2.7579	2.7692	-.41
25	775	1.000	477.594	.854	49.64	49.47	.35	2.7579	2.7657	-.28
25	776	1.000	510.928	.755	43.90	43.86	.09	2.7579	2.7599	-.07
25	777	1.000	310.928	9.700	563.83	563.51	.06	3.4474	3.6227	-4.84
25	778	1.000	344.261	8.983	522.11	521.67	.09	3.4474	3.6004	-4.25
25	779	1.000	377.594	8.091	470.30	469.84	.10	3.4474	3.5301	-2.34
25	780	1.000	410.928	6.641	385.99	386.18	-.05	3.4474	3.4390	.24
25	781	1.000	444.261	1.426	82.86	82.28	.71	3.4474	3.4614	-.41
25	782	1.000	477.594	1.144	66.47	66.08	.58	3.4474	3.4621	-.43
25	783	1.000	510.928	.987	57.39	57.23	.28	3.4474	3.4553	-.23
25	784	1.000	310.928	9.724	565.22	564.78	.08	4.1369	4.3824	-5.60
25	785	1.000	344.261	9.018	524.16	523.65	.10	4.1369	4.3189	-4.22
25	786	1.000	377.594	8.156	474.06	473.56	.10	4.1369	4.2328	-2.27
25	787	1.000	410.928	6.876	399.66	399.50	.04	4.1369	4.1468	-.24
25	788	1.000	444.261	2.057	119.54	119.17	.31	4.1369	4.1421	-.13
25	789	1.000	477.594	1.486	86.35	85.72	.72	4.1369	4.1568	-.48
25	790	1.000	510.928	1.244	72.28	71.97	.44	4.1369	4.1509	-.34
25	791	1.000	310.928	9.769	567.83	567.25	.10	5.5158	5.8502	-5.72
25	792	1.000	344.261	9.083	527.97	527.42	.10	5.5158	5.7228	-3.62
25	793	1.000	377.594	8.276	481.03	480.26	.16	5.5158	5.6882	-3.03
25	794	1.000	410.928	7.192	418.02	417.31	.17	5.5158	5.5837	-1.22
25	795	1.000	444.261	4.960	288.31	285.03	1.14	5.5158	5.5569	-.74
25	796	1.000	477.594	2.407	139.91	139.55	.26	5.5158	5.5233	-.14
25	797	1.000	510.928	1.844	107.16	106.59	.53	5.5158	5.5360	-.37
25	798	1.000	344.261	9.147	531.64	530.96	.13	6.8948	7.1738	-3.89
25	799	1.000	377.594	8.379	487.03	486.18	.18	6.8948	7.1066	-2.98
25	800	1.000	410.928	7.410	430.72	429.97	.17	6.8948	6.9882	-1.34
25	801	1.000	444.261	5.938	345.15	345.18	-.01	6.8948	6.8936	.02
25	802	1.000	477.594	3.672	213.44	214.08	-.30	6.8948	6.8827	.18
25	803	1.000	510.928	2.558	148.69	149.16	-.32	6.8948	6.8806	.21
25	804	1.000	310.928	9.864	573.32	572.47	.15	8.6184	9.1491	-5.80
25	805	1.000	344.261	9.211	535.38	535.09	.05	8.6184	8.7410	-1.40
25	806	1.000	377.594	8.495	493.79	492.76	.21	8.6184	8.9048	-3.22
25	807	1.000	410.928	7.621	442.99	442.25	.17	8.6184	8.7354	-1.34
25	808	1.000	444.261	6.492	377.35	376.62	.19	8.6184	8.6720	-.62
25	809	1.000	477.594	4.929	286.50	286.03	.17	8.6184	8.6338	-.18

Table 7. (Continued)

Data sources and ID numbers: (1)Virial Equation, (3)Beattie, (19)Kay, (25)Olds, (29)Sage, (XXXX)Haynes.

ID	Data Point No.	Weight	Temp. K	Density expt mol/L	Density expt kg/m^3	Density calc kg/m^3	Density Diff. %	P_{expt} MPa	P_{calc} MPa	Pressure Diff. %
25	810	1.000	510.928	3.533	205.34	207.17	-.89	8.6184	8.5611	.67
25	811	1.000	344.261	9.285	539.71	538.96	.14	10.3421	10.6851	-3.21
25	812	1.000	377.594	8.599	499.80	498.66	.23	10.3421	10.6951	-3.30
25	813	1.000	410.928	7.796	453.14	452.21	.21	10.3421	10.5198	-1.69
25	814	1.000	444.261	6.832	397.09	396.23	.22	10.3421	10.4325	-.87
25	815	1.000	477.594	5.627	327.04	326.98	.02	10.3421	10.3453	-.03
25	816	1.000	510.928	4.372	254.10	255.54	-.57	10.3421	10.2832	.57
25	817	1.000	310.928	9.956	578.70	577.81	.15	12.0658	12.6701	-4.77
25	818	1.000	344.261	9.348	543.37	542.61	.14	12.0658	12.4388	-3.00
25	819	1.000	377.594	8.694	505.31	504.01	.26	12.0658	12.5087	-3.54
25	820	1.000	410.928	7.947	461.89	460.66	.27	12.0658	12.3394	-2.22
25	821	1.000	444.261	7.083	411.68	410.76	.22	12.0658	12.1901	-1.02
25	822	1.000	477.594	6.066	352.60	352.94	-.10	12.0658	12.0384	.23
25	823	1.000	510.928	5.000	290.61	291.60	-.34	12.0658	12.0104	.46
25	824	1.000	310.928	10.003	581.43	580.33	.19	13.7895	14.5673	-5.34
25	825	1.000	344.261	9.406	546.71	546.05	.12	13.7895	14.1284	-2.40
25	826	1.000	377.594	8.777	510.14	508.93	.24	13.7895	14.2364	-3.14
25	827	1.000	410.928	8.072	469.20	468.04	.25	13.7895	14.0792	-2.06
25	828	1.000	444.261	7.281	423.21	422.43	.18	13.7895	13.9167	-.91
25	829	1.000	477.594	6.381	370.88	371.70	-.22	13.7895	13.7045	.62
25	830	1.000	510.928	5.452	316.88	318.27	-.44	13.7895	13.6869	.75
25	831	1.000	310.928	10.084	586.11	585.10	.17	17.2369	18.0005	-4.24
25	832	1.000	344.261	9.520	553.31	552.43	.16	17.2369	17.7406	-2.84
25	833	1.000	377.594	8.925	518.73	517.73	.19	17.2369	17.6585	-2.39
25	834	1.000	410.928	8.291	481.90	480.58	.27	17.2369	17.6406	-2.29
25	835	1.000	444.261	7.598	441.64	440.75	.20	17.2369	17.4305	-1.11
25	836	1.000	477.594	6.842	397.68	398.50	-.21	17.2369	17.1102	.74
25	837	1.000	510.928	6.085	353.69	355.09	-.40	17.2369	17.0750	.95
25	838	1.000	310.928	10.154	590.22	589.57	.11	20.6843	21.2051	-2.46
25	839	1.000	344.261	9.619	559.11	558.26	.15	20.6843	21.2133	-2.49
25	840	1.000	377.594	9.054	526.23	525.49	.14	20.6843	21.0366	-1.67
25	841	1.000	410.928	8.474	492.57	491.08	.30	20.6843	21.2216	-2.53
25	842	1.000	444.261	7.845	455.98	455.07	.20	20.6843	20.9289	-1.17
25	843	1.000	477.594	7.179	417.26	417.85	-.14	20.6843	20.5648	.58
25	844	1.000	510.928	6.517	378.78	380.29	-.40	20.6843	20.4452	1.17
25	845	1.000	310.928	10.226	594.38	593.77	.10	24.1316	24.6478	-2.09
25	846	1.000	344.261	9.707	564.23	563.63	.11	24.1316	24.5336	-1.64
25	847	1.000	377.594	9.171	533.06	532.44	.12	24.1316	24.4558	-1.33
25	848	1.000	410.928	8.626	501.36	500.15	.24	24.1316	24.6249	-2.00
25	849	1.000	444.261	8.049	467.83	466.91	.20	24.1316	24.4237	-1.20
25	850	1.000	477.594	7.442	432.58	433.11	-.12	24.1316	24.0008	.55
25	851	1.000	510.928	6.844	397.78	399.40	-.41	24.1316	23.8062	1.37
25	852	1.000	310.928	10.287	597.93	597.74	.03	27.5790	27.7434	-.59
25	853	1.000	344.261	9.787	568.84	568.62	.04	27.5790	27.7331	-.56
25	854	1.000	377.594	9.273	538.98	538.77	.04	27.5790	27.7010	-.44
25	855	1.000	410.928	8.760	509.17	508.19	.19	27.5790	28.0273	-1.60
25	856	1.000	444.261	8.227	478.16	477.07	.23	27.5790	27.9790	-1.43
25	857	1.000	477.594	7.664	445.45	445.78	-.07	27.5790	27.4837	.35
25	858	1.000	510.928	7.108	413.17	414.82	-.40	27.5790	27.1768	1.48
25	859	1.000	310.928	10.345	601.29	601.52	-.04	31.0264	30.8183	.68
25	860	1.000	344.261	9.864	573.32	573.29	.00	31.0264	31.0428	-.05
25	861	1.000	377.594	9.374	544.85	544.58	.05	31.0264	31.1915	-.53
25	862	1.000	410.928	8.879	516.06	515.42	.12	31.0264	31.3489	-1.03
25	863	1.000	444.261	8.377	486.88	486.00	.18	31.0264	31.3901	-1.16
25	864	1.000	477.594	7.856	456.63	456.65	-.01	31.0264	31.0184	.03
25	865	1.000	510.928	7.333	426.25	427.79	-.36	31.0264	30.5886	1.43

Table 7. (Continued)

Data sources and ID numbers: (1)Virial Equation, (3)Beattie, (19)Kay, (25)Olds, (29)Sage, (XXXX)Haynes.

ID	Data Point No.	Weight	Temp. K	Density expt mol/L	Density expt kg/m^3	Density calc kg/m^3	Density Diff. %	P_{expt} MPa	P_{calc} MPa	Pressure Diff. %
25	866	1.000	310.928	10.404	604.70	605.11	-.07	34.4738	34.0697	1.19
25	867	1.000	344.261	9.935	577.45	577.69	-.04	34.4738	34.2789	.57
25	868	1.000	377.594	9.464	550.08	549.97	.02	34.4738	34.5517	-.23
25	869	1.000	410.928	8.989	522.45	522.01	.09	34.4738	34.7202	-.71
25	870	1.000	444.261	8.516	495.01	493.99	.21	34.4738	34.9397	-1.33
25	871	1.000	477.594	8.023	466.33	466.20	.03	34.4738	34.5225	-.14
25	872	1.000	510.928	7.526	437.42	439.00	-.36	34.4738	33.9619	1.51
25	873	1.000	310.928	10.515	611.16	611.84	-.11	41.3685	40.6438	1.78
25	874	1.000	344.261	10.076	585.68	585.79	-.02	41.3685	41.2710	.24
25	875	1.000	377.594	9.629	559.69	559.72	-.00	41.3685	41.3507	.04
25	876	1.000	410.928	9.186	533.95	533.69	.05	41.3685	41.5322	-.39
25	877	1.000	444.261	8.754	508.85	507.87	.19	41.3685	41.8994	-1.27
25	878	1.000	477.594	8.306	482.77	482.47	.06	41.3685	41.5091	-.34
25	879	1.000	510.928	7.847	456.11	457.75	-.36	41.3685	40.7022	1.64
25	880	1.000	310.928	10.612	616.81	618.05	-.20	48.2633	46.8447	3.03
25	881	1.000	344.261	10.199	592.84	593.14	-.05	48.2633	47.9678	.62
25	882	1.000	377.594	9.773	568.03	568.39	-.06	48.2633	47.9615	.63
25	883	1.000	410.928	9.364	544.29	543.87	.08	48.2633	48.5648	-.62
25	884	1.000	444.261	8.959	520.76	519.71	.20	48.2633	48.9193	-1.34
25	885	1.000	477.594	8.545	496.70	496.08	.12	48.2633	48.6023	-.70
25	886	1.000	510.928	8.118	471.83	473.16	-.28	48.2633	47.6182	1.35
25	887	1.000	310.928	10.703	622.08	623.82	-.28	55.1581	53.0290	4.01
25	888	1.000	344.261	10.318	599.72	599.88	-.03	55.1581	54.9898	.31
25	889	1.000	377.594	9.910	576.00	576.23	-.04	55.1581	54.9459	.39
25	890	1.000	410.928	9.520	553.31	552.93	.07	55.1581	55.4693	-.56
25	891	1.000	444.261	9.129	530.59	530.08	.10	55.1581	55.5157	-.64
25	892	1.000	477.594	8.741	508.04	507.82	.04	55.1581	55.2935	-.24
25	893	1.000	510.928	8.351	485.41	486.29	-.18	55.1581	54.6653	.90
25	894	1.000	310.928	10.795	627.44	629.22	-.28	62.0528	59.7311	3.89
25	895	1.000	344.261	10.419	605.61	606.11	-.08	62.0528	61.4836	.93
25	896	1.000	377.594	10.032	583.13	583.39	-.05	62.0528	61.7870	.43
25	897	1.000	410.928	9.656	561.26	561.11	.03	62.0528	62.1925	-.22
25	898	1.000	444.261	9.288	539.89	539.34	.10	62.0528	62.4870	-.69
25	899	1.000	477.594	8.916	518.23	518.18	.01	62.0528	62.0842	-.05
25	900	1.000	510.928	8.553	497.16	497.76	-.12	62.0528	61.6728	.62
25	901	1.000	310.928	10.876	632.14	634.30	-.34	68.9476	65.9679	4.52
25	902	1.000	344.261	10.515	611.16	611.92	-.13	68.9476	68.0138	1.37
25	903	1.000	377.594	10.147	589.78	590.00	-.04	68.9476	68.7078	.35
25	904	1.000	410.928	9.790	569.04	568.58	.08	68.9476	69.3934	-.64
25	905	1.000	444.261	9.444	548.95	547.71	.23	68.9476	70.0280	-1.54
25	906	1.000	477.594	9.086	528.14	527.48	.13	68.9476	69.4654	-.75
25	907	1.000	510.928	8.729	507.40	507.96	-.11	68.9476	68.5440	.59

Table 7. (Continued)

Data sources and ID numbers: (1)Virial Equation, (3)Beattie, (19)Kay, (25)Olds, (29)Sage, (XXXX)Haynes.

ID	Data Point No.	Weight	Temp. K	Density expt mol/L	Density expt kg/m^3	Density calc kg/m^3	Density Diff. %	P_{expt} MPa	P_{calc} MPa	Pressure Diff. %
29	908	.000	294.261	.043	2.48	2.49	-.21	.1013	.1011	.21
29	909	.000	294.261	.059	3.42	3.43	-.09	.1379	.1378	.09
29	910	.000	294.261	.091	5.26	5.26	.09	.2068	.2070	-.08
29	911	.000	294.261	10.062	584.83	579.62	.89	1.7237	5.0879	-66.12
29	912	.000	294.261	10.121	588.27	582.34	1.01	3.4474	7.4607	-53.79
29	913	.000	294.261	10.173	591.31	584.95	1.07	5.1711	9.6655	-46.50
29	914	.000	294.261	10.218	593.94	587.46	1.09	6.8948	11.6557	-40.85
29	915	.000	294.261	10.256	596.15	589.88	1.05	8.6184	13.3881	-35.63
29	916	.000	294.261	10.299	598.60	592.21	1.07	10.3421	15.3744	-32.73
29	917	.000	294.261	10.341	601.07	594.47	1.10	12.0658	17.4482	-30.85
29	918	.000	294.261	10.380	603.33	596.65	1.11	13.7895	19.4126	-28.97
29	919	.000	294.261	10.415	605.38	598.77	1.09	15.5132	21.2471	-26.99
29	920	.000	294.261	10.447	607.22	600.82	1.05	17.2369	22.9325	-24.84
29	921	.000	294.261	10.475	608.84	602.82	.99	18.9606	24.4507	-22.45
29	922	.000	294.261	10.487	609.53	604.76	.78	20.6843	25.1140	-17.64
29	923	.000	310.928	.040	2.34	2.34	-.18	.1013	.1012	.17
29	924	.000	310.928	.055	3.22	3.22	-.12	.1379	.1377	.12
29	925	.000	310.928	.085	4.92	4.92	-.02	.2068	.2068	.02
29	926	.000	310.928	.115	6.70	6.69	.13	.2758	.2761	-.12
29	927	.000	310.928	.148	8.58	8.55	.33	.3447	.3458	-.30
29	928	.000	310.928	9.711	564.43	560.20	.75	1.7237	3.9457	-56.31
29	929	.000	310.928	9.773	568.03	563.51	.80	3.4474	5.9663	-42.22
29	930	.000	310.928	9.825	571.07	566.64	.78	5.1711	7.7630	-33.39
29	931	.000	310.928	9.881	574.34	569.62	.82	6.8948	9.7990	-29.64
29	932	.000	310.928	9.935	577.45	572.47	.86	8.6184	11.8259	-27.12
29	933	.000	310.928	9.982	580.17	575.19	.86	10.3421	13.6799	-24.40
29	934	.000	310.928	10.025	582.70	577.81	.84	12.0658	15.4753	-22.03
29	935	.000	310.928	10.073	585.47	580.33	.88	13.7895	17.5152	-21.27
29	936	.000	310.928	10.117	588.05	582.75	.90	15.5132	19.4898	-20.40
29	937	.000	310.928	10.166	590.87	585.10	.98	17.2369	21.7325	-20.69
29	938	.000	310.928	10.207	593.28	587.37	1.00	18.9606	23.7179	-20.06
29	939	.000	310.928	10.241	595.26	589.57	.96	20.6843	25.4044	-18.58
29	940	.000	327.594	.038	2.21	2.22	-.11	.1013	.1012	.11
29	941	.000	327.594	.052	3.04	3.04	-.06	.1379	.1378	.06
29	942	.000	327.594	.080	4.63	4.63	.04	.2068	.2069	-.04
29	943	.000	327.594	.108	6.28	6.27	.16	.2758	.2762	-.15
29	944	.000	327.594	.138	8.00	7.98	.22	.3447	.3454	-.21
29	945	.000	327.594	.168	9.79	9.75	.40	.4137	.4152	-.36
29	946	.000	327.594	.201	11.66	11.61	.48	.4826	.4847	-.42
29	947	.000	327.594	.235	13.63	13.55	.58	.5516	.5543	-.49
29	948	.000	327.594	9.355	543.74	539.31	.81	1.7237	3.5829	-51.89
29	949	.000	327.594	9.432	548.20	543.43	.87	3.4474	5.6109	-38.56
29	950	.000	327.594	9.500	552.17	547.26	.89	5.1711	7.5451	-31.46
29	951	.000	327.594	9.566	556.00	550.87	.92	6.8948	9.5360	-27.70
29	952	.000	327.594	9.633	559.89	554.27	1.00	8.6184	11.6824	-26.23
29	953	.000	327.594	9.690	563.24	557.49	1.02	10.3421	13.6372	-24.16
29	954	.000	327.594	9.742	566.22	560.56	1.00	12.0658	15.4674	-21.99
29	955	.000	327.594	9.790	569.04	563.49	.98	13.7895	17.2696	-20.15
29	956	.000	327.594	9.846	572.29	566.30	1.05	15.5132	19.4459	-20.22
29	957	.000	327.594	9.896	575.17	568.99	1.07	17.2369	21.4577	-19.67
29	958	.000	327.594	9.945	578.08	571.58	1.12	18.9606	23.5748	-19.57
29	959	.000	327.594	9.985	580.38	574.08	1.09	20.6843	25.3154	-18.29
29	960	.000	344.261	.036	2.10	2.10	-.09	.1013	.1012	.09
29	961	.000	344.261	.050	2.88	2.88	-.05	.1379	.1378	.04
29	962	.000	344.261	.075	4.38	4.38	.03	.2068	.2069	-.03

Table 7. (Continued)

Data sources and ID numbers: (1)Virial Equation, (3)Beattie, (19)Kay, (25)Olds, (29)Sage, (XXXX)Haynes.

ID	Data Point No.	Weight	Temp. K	Density expt mol/L	Density expt kg/m^3	Density calc kg/m^3	Density Diff. %	P_{expt} MPa	P_{calc} MPa	Pressure Diff. %
29	963	.000	344.261	.102	5.92	5.91	.16	.2758	.2762	-.16
29	964	.000	344.261	.129	7.52	7.50	.26	.3447	.3456	-.24
29	965	.000	344.261	.158	9.17	9.13	.38	.4137	.4151	-.35
29	966	.000	344.261	.187	10.87	10.82	.43	.4826	.4845	-.38
29	967	.000	344.261	.217	12.63	12.57	.49	.5516	.5540	-.43
29	968	.000	344.261	.249	14.47	14.39	.53	.6205	.6234	-.45
29	969	.000	344.261	.282	16.37	16.29	.50	.6895	.6924	-.42
29	970	.000	344.261	8.977	521.77	516.36	1.04	1.7237	3.4838	-50.52
29	971	.000	344.261	9.074	527.44	521.67	1.10	3.4474	5.5245	-37.60
29	972	.000	344.261	9.159	532.35	526.50	1.10	5.1711	7.4631	-30.71
29	973	.000	344.261	9.236	536.81	530.96	1.09	6.8948	9.3704	-26.42
29	974	.000	344.261	9.314	541.35	535.09	1.16	8.6184	11.4587	-24.79
29	975	.000	344.261	9.380	545.22	538.96	1.15	10.3421	13.3641	-22.61
29	976	.000	344.261	9.448	549.14	542.61	1.19	12.0658	15.4180	-21.74
29	977	.000	344.261	9.510	552.74	546.05	1.21	13.7895	17.4131	-20.81
29	978	.000	344.261	9.569	556.20	549.32	1.24	15.5132	19.4311	-20.16
29	979	.000	344.261	9.623	559.30	552.43	1.23	17.2369	21.3355	-19.21
29	980	.000	344.261	9.670	562.05	555.41	1.18	18.9606	23.0919	-17.89
29	981	.000	344.261	9.707	564.23	558.26	1.06	20.6843	24.5336	-15.69
29	982	.000	360.928	.034	2.00	2.00	-.05	.1013	.1013	.04
29	983	.000	360.928	.047	2.74	2.74	-.00	.1379	.1379	.00
29	984	.000	360.928	.071	4.16	4.15	.07	.2068	.2070	-.07
29	985	.000	360.928	.097	5.61	5.60	.21	.2758	.2763	-.20
29	986	.000	360.928	.122	7.10	7.08	.32	.3447	.3458	-.30
29	987	.000	360.928	.149	8.64	8.60	.41	.4137	.4153	-.38
29	988	.000	360.928	.176	10.21	10.16	.47	.4826	.4847	-.43
29	989	.000	360.928	.203	11.83	11.77	.48	.5516	.5540	-.43
29	990	.000	360.928	.232	13.50	13.42	.55	.6205	.6236	-.49
29	991	.000	360.928	.262	15.21	15.13	.53	.6895	.6927	-.46
29	992	.000	360.928	.340	19.79	19.68	.57	.8618	.8659	-.47
29	993	.000	360.928	.427	24.79	24.71	.33	1.0342	1.0369	-.26
29	994	.000	360.928	8.495	493.79	490.31	.70	1.7237	2.5204	-31.61
29	995	.000	360.928	8.620	501.05	497.55	.70	3.4474	4.3730	-21.17
29	996	.000	360.928	8.729	507.40	503.89	.69	5.1711	6.2172	-16.83
29	997	.000	360.928	8.830	513.25	509.55	.72	6.8948	8.1161	-15.05
29	998	.000	360.928	8.925	518.73	514.70	.78	8.6184	10.0799	-14.50
29	999	.000	360.928	9.015	523.99	519.43	.87	10.3421	12.1408	-14.82
29	1000	.000	360.928	9.095	528.66	523.81	.92	12.0658	14.1236	-14.57
29	1001	.000	360.928	9.171	533.06	527.90	.97	13.7895	16.1297	-14.51
29	1002	.000	360.928	9.242	537.17	531.74	1.01	15.5132	18.1320	-14.44
29	1003	.000	360.928	9.307	540.98	535.37	1.04	17.2369	20.1012	-14.25
29	1004	.000	360.928	9.205	535.02	538.80	-.71	18.9606	17.0679	11.09
29	1005	.000	360.928	9.415	547.27	542.07	.95	20.6843	23.5998	-12.35
29	1006	.000	377.594	.033	1.91	1.91	-.01	.1013	.1013	.01
29	1007	.000	377.594	.045	2.61	2.61	.04	.1379	.1380	-.04
29	1008	.000	377.594	.068	3.96	3.95	.14	.2068	.2071	-.14
29	1009	.000	377.594	.092	5.33	5.32	.27	.2758	.2765	-.26
29	1010	.000	377.594	.116	6.74	6.72	.34	.3447	.3459	-.33
29	1011	.000	377.594	.141	8.18	8.14	.47	.4137	.4155	-.44
29	1012	.000	377.594	.166	9.65	9.60	.52	.4826	.4850	-.49
29	1013	.000	377.594	.192	11.15	11.09	.55	.5516	.5544	-.51
29	1014	.000	377.594	.218	12.69	12.62	.56	.6205	.6237	-.51
29	1015	.000	377.594	.245	14.26	14.18	.55	.6895	.6929	-.49
29	1016	.000	377.594	.316	18.38	18.29	.51	.8618	.8656	-.44
29	1017	.000	377.594	.392	22.81	22.71	.45	1.0342	1.0380	-.37
29	1018	.000	377.594	.476	27.66	27.53	.46	1.2066	1.2109	-.36

Table 7. (Continued)

Data sources and ID numbers: (1)Virial Equation, (3)Beattie, (19)Kay, (25)Olds, (29)Sage, (XXXX)Haynes.

ID	Data Point No.	Weight	Temp. K	Density expt mol/L	Density expt kg/m^3	Density calc kg/m^3	Density Diff. %	P_{expt} MPa	P_{calc} MPa	Pressure Diff. %
29	1019	.000	377.594	.569	33.07	32.88	.57	1.3790	1.3847	-.41
29	1020	.000	377.594	.675	39.24	38.96	.72	1.5513	1.5587	-.47
29	1021	.000	377.594	7.937	461.36	458.95	.52	1.7237	2.0697	-16.72
29	1022	.000	377.594	8.113	471.55	469.84	.36	3.4474	3.7570	-8.24
29	1023	.000	377.594	8.254	479.74	478.67	.22	5.1711	5.4023	-4.28
29	1024	.000	377.594	8.392	487.77	486.18	.33	6.8948	7.2934	-5.47
29	1025	.000	377.594	8.527	495.62	492.76	.58	8.6184	9.4314	-8.62
29	1026	.000	377.594	8.626	501.36	498.66	.54	10.3421	11.1923	-7.60
29	1027	.000	377.594	8.721	506.91	504.01	.57	12.0658	13.0660	-7.65
29	1028	.000	377.594	8.808	511.94	508.93	.59	13.7895	14.9132	-7.53
29	1029	.000	377.594	8.884	516.39	513.48	.56	15.5132	16.6800	-7.00
29	1030	.000	377.594	8.962	520.93	517.73	.61	17.2369	18.6074	-7.37
29	1031	.000	377.594	9.021	524.34	521.72	.50	18.9606	20.1468	-5.89
29	1032	.000	377.594	9.077	527.62	525.49	.40	20.6843	21.7036	-4.70
29	1033	.000	394.261	.031	1.82	1.82	.04	.1013	.1014	-.04
29	1034	.000	394.261	.043	2.50	2.49	.09	.1379	.1380	-.09
29	1035	.000	394.261	.065	3.78	3.77	.19	.2068	.2072	-.18
29	1036	.000	394.261	.088	5.09	5.07	.34	.2758	.2767	-.32
29	1037	.000	394.261	.110	6.42	6.39	.44	.3447	.3462	-.42
29	1038	.000	394.261	.134	7.78	7.74	.56	.4137	.4159	-.54
29	1039	.000	394.261	.158	9.16	9.11	.61	.4826	.4854	-.57
29	1040	.000	394.261	.182	10.57	10.50	.65	.5516	.5549	-.60
29	1041	.000	394.261	.207	12.01	11.93	.69	.6205	.6245	-.64
29	1042	.000	394.261	.232	13.47	13.38	.65	.6895	.6936	-.59
29	1043	.000	394.261	.297	17.25	17.15	.58	.8618	.8663	-.51
29	1044	.000	394.261	.366	21.26	21.15	.53	1.0342	1.0389	-.45
29	1045	.000	394.261	.440	25.55	25.41	.54	1.2066	1.2120	-.45
29	1046	.000	394.261	.520	30.21	29.99	.71	1.3790	1.3867	-.56
29	1047	.000	394.261	.608	35.36	34.97	1.10	1.5513	1.5642	-.82
29	1048	.000	394.261	.706	41.06	40.46	1.47	1.7237	1.7416	-1.03
29	1049	.000	394.261	.819	47.59	46.63	2.02	1.8961	1.9209	-1.29
29	1050	.000	394.261	.949	55.16	53.79	2.49	2.0684	2.0982	-1.42
29	1051	.000	394.261	7.471	434.22	435.83	-.37	3.4474	3.2783	5.16
29	1052	.000	394.261	7.709	448.07	449.50	-.32	5.1711	4.9656	4.14
29	1053	.000	394.261	7.897	458.98	460.08	-.24	6.8948	6.6991	2.92
29	1054	.000	394.261	8.049	467.83	468.83	-.21	8.6184	8.4059	2.53
29	1055	.000	394.261	8.178	475.33	476.38	-.22	10.3421	10.0880	2.52
29	1056	.000	394.261	8.293	482.05	483.03	-.20	12.0658	11.7982	2.27
29	1057	.000	394.261	8.397	488.07	489.02	-.19	13.7895	13.5049	2.11
29	1058	.000	394.261	8.488	493.33	494.47	-.23	15.5132	15.1406	2.46
29	1059	.000	394.261	8.569	498.09	499.49	-.28	17.2369	16.7421	2.96
29	1060	.000	394.261	8.647	502.62	504.14	-.30	18.9606	18.3830	3.14
29	1061	.000	394.261	8.718	506.75	508.49	-.34	20.6843	19.9820	3.51

Table 8. Comparisons of data for ideal gas functions with eq (7).

Normal butane ideal gas functions from Chen, et al. [12]

Temp.	$H^o-H^o_o$, J/mol		Diff.	S^o, J/(mol K)		Diff.	C^o_p, J/(mol K)		Diff.
K	expt.	calc.	%	expt.	calc.	%	expt.	calc.	%
50.00	1718.0	1750.3	-1.88	198.363	198.892	-.27	38.07	38.08	-.01
100.00	4048.9	4041.8	.17	229.994	229.925	.03	55.35	55.34	.03
150.00	7142.7	7143.6	-.01	254.889	254.915	-.01	67.32	67.37	-.07
200.00	10736.1	10733.0	.03	275.516	275.505	.00	76.44	76.33	.14
273.15	16883.5	16881.3	.01	301.583	301.574	.00	92.30	92.40	-.11
298.15	19267.0	19268.1	-.01	309.909	309.931	-.01	98.49	98.59	-.10
300.00	19450.6	19450.9	-.00	310.536	310.542	-.00	98.95	99.05	-.10
400.00	30636.9	30632.2	.02	342.544	342.533	.00	124.77	124.54	.18
500.00	44333.7	44299.9	.08	373.004	372.932	.02	148.66	148.37	.19
600.00	60259.6	60207.1	.09	401.999	401.877	.03	169.28	169.26	.01
700.00	78096.5	78054.9	.05	429.446	429.354	.02	187.02	187.23	-.11
800.00	97584.3	97567.5	.02	455.428	455.386	.01	202.38	202.63	-.12
900.00	118507.2	118509.3	-.00	480.072	480.037	.01	215.73	215.88	-.07
1000.00	140674.4	140684.2	-.01	503.419	503.390	.01	227.36	227.35	.00
1100.00	163928.3	163930.2	-.00	525.552	525.538	.00	237.48	237.35	.06
1200.00	188124.4	188113.2	.01	546.640	546.574	.01	246.27	246.13	.06

Table 9. Interpolated ideal gas functions from eq (7).

Temp. K	$E^o-E^o_o$ J/mol	$H^o-H^o_o$ J/mol	S^o J/(mol•K)	C^o_v J/(mol•K)	C^o_p J/(mol•K)
130.0	4753.0	5833.9	245.551	55.17	63.48
140.0	5315.1	6479.1	250.331	57.20	65.51
150.0	5896.4	7143.6	254.915	59.05	67.37
160.0	6495.8	7826.1	259.319	60.82	69.13
170.0	7112.7	8526.2	263.563	62.56	70.88
180.0	7747.1	9243.7	267.663	64.32	72.64
190.0	8399.4	9979.1	271.639	66.14	74.45
200.0	9070.1	10733.0	275.505	68.02	76.33
210.0	9760.0	11506.0	279.276	69.98	78.29
220.0	10469.9	12299.1	282.965	72.02	80.33
230.0	11200.6	13112.9	286.583	74.14	82.45
240.0	11952.9	13948.4	290.138	76.34	84.65
250.0	12727.6	14806.2	293.639	78.61	86.92
260.0	13525.2	15687.0	297.094	80.94	89.25
270.0	14346.5	16591.4	300.507	83.32	91.64
280.0	15191.9	17519.9	303.883	85.76	94.07
290.0	16061.8	18473.0	307.227	88.23	96.55
300.0	16956.6	19450.9	310.542	90.74	99.05
310.0	17876.6	20454.1	313.831	93.27	101.58
320.0	18822.0	21482.6	317.097	95.82	104.13
330.0	19792.9	22536.7	320.340	98.38	106.69
340.0	20789.5	23616.4	323.563	100.94	109.26
350.0	21811.8	24721.8	326.767	103.51	111.82
360.0	22859.7	25852.9	329.953	106.07	114.39
370.0	23933.2	27009.6	333.122	108.63	116.95
380.0	25032.3	28191.8	336.275	111.18	119.49
390.0	26156.7	29399.4	339.412	113.71	122.02
400.0	27306.4	30632.2	342.533	116.22	124.54
410.0	28481.1	31890.1	345.639	118.72	127.04
420.0	29680.7	33172.8	348.730	121.20	129.51
430.0	30905.0	34480.2	351.806	123.65	131.96
440.0	32153.6	35812.0	354.867	126.07	134.39
450.0	33426.4	37167.9	357.914	128.48	136.79
460.0	34723.0	38547.7	360.947	130.85	139.16
470.0	36043.3	39951.1	363.965	133.19	141.51
480.0	37386.8	41377.8	366.969	135.51	143.83
490.0	38753.4	42827.5	369.958	137.80	146.11
500.0	40142.7	44299.9	372.932	140.06	148.37
510.0	41554.4	45794.8	375.893	142.28	150.60
520.0	42988.2	47311.8	378.838	144.48	152.79
530.0	44443.9	48850.6	381.769	146.64	154.96
540.0	45921.0	50410.9	384.686	148.78	157.09
550.0	47419.4	51992.4	387.588	150.88	159.20
560.0	48938.6	53594.7	390.475	152.96	161.27
570.0	50478.4	55217.7	393.347	155.00	163.32
580.0	52038.5	56861.0	396.205	157.01	165.33
590.0	53618.6	58524.2	399.048	159.00	167.31
600.0	55218.4	60207.1	401.877	160.95	169.26
610.0	56837.5	61909.4	404.690	162.87	171.19
620.0	58475.8	63630.8	407.489	164.77	173.08
630.0	60132.8	65371.0	410.274	166.63	174.95
640.0	61808.4	67129.6	413.043	168.47	176.78
650.0	63502.1	68906.6	415.798	170.28	178.59
660.0	65213.9	70701.4	418.539	172.06	180.37
670.0	66943.3	72514.0	421.264	173.81	182.13
680.0	68690.0	74343.9	423.975	175.54	183.86
690.0	70454.0	76191.0	426.672	177.24	185.56
700.0	72234.8	78054.9	429.354	178.91	187.23

Table 10. Comparisons of heat of vaporization data with eq (9).

Data sources and ID numbers: (10)Dana, (11)Das (1967), (29)Sage, (35)Das (1973), (40)Thermal Loops, (41)Clapeyron.

ID	Weight	Temp. K	Heat of Vaporization kJ/mol expt.	calc.	Diff. %
40	1.000	134.860	28.746	28.789	-.15
40	.998	140.000	28.499	28.521	-.08
40	.995	150.000	28.022	28.016	.02
40	.992	160.000	27.553	27.533	.07
40	.988	170.000	27.090	27.067	.08
40	.984	180.000	26.635	26.615	.07
40	.979	190.000	26.186	26.174	.05
40	.974	200.000	25.742	25.739	.01
40	.969	210.000	25.301	25.307	-.02
40	.963	220.000	24.861	24.875	-.05
40	.957	230.000	24.417	24.438	-.08
40	.950	240.000	23.965	23.992	-.11
40	.943	250.000	23.503	23.535	-.14
40	.934	260.000	23.024	23.061	-.16
40	.925	270.000	22.524	22.567	-.19
41	.998	140.000	28.521	28.521	.00
41	.995	150.000	28.032	28.016	.05
41	.991	160.000	27.551	27.533	.07
41	.986	170.000	27.082	27.067	.06
41	.982	180.000	26.624	26.615	.03
41	.977	190.000	26.176	26.174	.01
41	.971	200.000	25.735	25.739	-.01
41	.966	210.000	25.299	25.307	-.03
41	.959	220.000	24.865	24.875	-.04
41	.952	230.000	24.429	24.438	-.04
41	.945	240.000	23.987	23.992	-.02
41	.936	250.000	23.536	23.535	.00
41	.927	260.000	23.070	23.061	.04
41	.917	270.000	22.586	22.567	.09
41	.905	280.000	22.077	22.048	.13
41	.892	290.000	21.535	21.500	.17
41	.876	300.000	20.955	20.917	.18
41	.859	310.000	20.328	20.294	.17
41	.839	320.000	19.650	19.626	.12
41	.815	330.000	18.915	18.906	.05
41	.786	340.000	18.118	18.125	-.04
41	.751	350.000	17.253	17.274	-.12
41	.708	360.000	16.312	16.340	-.17
41	.653	370.000	15.282	15.306	-.15
41	.581	380.000	14.139	14.147	-.06
41	.484	390.000	12.841	12.824	.13
41	0.000	400.000	11.306	11.262	.39
41	0.000	410.000	9.344	9.292	.56
41	0.000	420.000	6.264	6.273	-.15
11	0.000	272.660	22.389	22.431	-.19
10	0.000	274.970	22.252	22.312	-.27
10	0.000	275.520	22.182	22.284	-.46
10	0.000	279.730	22.009	22.062	-.24
11	0.000	280.000	22.016	22.048	-.14
35	0.000	280.000	22.037	22.048	-.05
10	0.000	284.940	21.768	21.781	-.06
10	0.000	285.790	21.749	21.734	.07
11	0.000	290.000	21.481	21.500	-.09
35	0.000	290.000	21.548	21.500	.23
10	0.000	290.480	21.515	21.472	.20
10	0.000	295.310	21.240	21.195	.21
10	0.000	297.480	21.092	21.067	.12
11	0.000	300.000	20.887	20.917	-.14
35	0.000	300.000	21.037	20.917	.57
11	0.000	310.000	20.251	20.294	-.21
35	0.000	310.000	20.510	20.294	1.06
11	0.000	320.000	19.581	19.626	-.23
35	0.000	320.000	19.933	19.626	1.56

Table 10. (Continued).

Data sources and ID numbers: (10)Dana, (11)Das (1967), (29)Sage, (35)Das (1973), (40)Thermal Loops, (41)Clapeyron.

ID	Weight	Temp. K	Heat of Vaporization kJ/mol expt.	calc.	Diff. %
11	0.000	330.000	18.903	18.906	-.01
35	0.000	330.000	19.255	18.906	1.85
11	0.000	340.000	18.184	18.125	.33
35	0.000	340.000	18.477	18.125	1.94
11	0.000	350.000	17.405	17.274	.76
35	0.000	350.000	17.569	17.274	1.71
11	0.000	360.000	16.552	16.340	1.30
35	0.000	360.000	16.564	16.340	1.37
11	0.000	370.000	15.573	15.306	1.75
35	0.000	370.000	15.443	15.306	.90
11	0.000	380.000	14.447	14.147	2.12
35	0.000	380.000	14.209	14.147	.44
11	0.000	390.000	13.138	12.824	2.45
35	0.000	390.000	12.837	12.824	.10
11	0.000	400.000	11.506	11.262	2.17
35	0.000	400.000	11.209	11.262	-.47
35	0.000	405.000	10.251	10.347	-.92
11	0.000	410.000	9.263	9.292	-.31
35	0.000	410.000	9.184	9.292	-1.16
35	0.000	415.000	7.895	8.012	-1.46
11	0.000	420.000	6.138	6.273	-2.16
35	0.000	420.000	5.916	6.273	-5.69
29	0.000	294.260	21.479	21.256	1.05
29	0.000	310.930	20.382	20.234	.73
29	0.000	327.590	19.120	19.085	.19
29	0.000	344.260	17.712	17.771	-.33
29	0.000	360.930	16.094	16.248	-.95
29	0.000	377.590	14.096	14.440	-2.38
29	0.000	394.260	11.622	12.194	-4.69

Number of data points used in fit = 41; rms deviation = 0.095%.

Table 11. Enthalpies of saturated liquid normal butane from eq (10).

Temp. K	H_σ[1] J/mol	H_σ (eq (10)) J/mol	Diff. %
134.86	.0	.0	0.000
140.00	602.8	602.9	-.023
150.00	1771.6	1771.6	.001
160.00	2937.3	2937.2	.005
170.00	4102.5	4102.4	.002
180.00	5270.5	5270.6	-.001
190.00	6444.5	6444.7	-.003
200.00	7627.7	7627.9	-.003
210.00	8823.4	8823.5	-.000
220.00	10034.6	10034.4	.002
230.00	11264.0	11263.7	.003
240.00	12514.2	12514.0	.001
250.00	13787.9	13787.9	.000
260.00	15087.5	15087.6	-.001
270.00	16414.8	16415.2	-.002
280.00	17772.3	17772.6	-.002
290.00	19161.4	19161.6	-.00[illegible]
300.00	20584.1	20584.0	.00[illegible]
310.00	22041.9	22041.5	.001
320.00	23536.8	23536.3	.002
330.00	25070.8	25070.6	.001
340.00	26646.9	26647.1	-.001
350.00	28268.8	28269.2	-.001
360.00	29940.6	29941.2	-.002
370.00	31668.3	31668.7	-.001
380.00	33460.0	33459.6	.001
390.00	35327.5	35326.6	.003
400.00	37293.8	37293.1	.002
410.00	39414.3	39416.2	-.005
420.00	41932.5	41931.6	.002
425.16	45399.8	45399.8	0.000

Number of points = 29; rms deviation = 0.005%.

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[1] Derived from ideal gas functions, the equation of state, and the formulated heats of vaporization.

Table 12. Entropies and specific heats of saturated liquid normal butane from eq (11).

Temp. K	S_σ[1] J/(mol•K)	S_σ (eq (11)) J/(mol•K)	Diff. %	C_σ J/(mol•K)
134.86	133.544	133.544	0.000	117.39
140.00	137.932	137.929	.002	117.07
150.00	145.992	145.989	.002	116.61
160.00	153.507	153.507	.000	116.42
170.00	160.565	160.567	-.001	116.54
180.00	167.237	167.239	-.001	116.99
190.00	173.582	173.584	-.001	117.77
200.00	179.652	179.651	.000	118.88
210.00	185.486	185.484	.001	120.29
220.00	191.120	191.118	.001	121.98
230.00	196.584	196.582	.001	123.92
240.00	201.902	201.901	.000	126.10
250.00	207.096	207.097	-.000	128.48
260.00	212.183	212.185	-.001	131.05
270.00	217.180	217.182	-.001	133.79
280.00	222.098	222.100	-.001	136.70
290.00	226.950	226.950	-.000	139.78
300.00	231.744	231.743	.000	143.02
310.00	236.490	236.488	.001	146.44
320.00	241.196	241.194	.001	150.05
330.00	245.870	245.869	.000	153.88
340.00	250.521	250.522	-.000	157.94
350.00	255.160	255.163	-.001	162.29
360.00	259.797	259.800	-.001	167.03
370.00	264.446	264.447	-.000	172.29
380.00	269.122	269.120	.001	178.40
390.00	273.854	273.848	.002	186.05
400.00	278.689	278.686	.001	196.99
410.00	283.753	283.765	-.004	217.06
420.00	289.605	289.598	.002	287.81
425.16	297.647	297.647	0.000	--

Number of points = 29; rms deviation = 0.001%.

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[1] Derived from ideal gas functions, equation of state, and formulated heats of vaporization.

Table 13. Comparisons of dielectric constant data with eq (12).

Data sources and ID numbers: (16)Sliwinski, (20)Haynes, Saturated liquid, (XXXX)Haynes, Compressed Liquid.

ID	Weight	Temp. K	Pressure MPa	Density kg/m^3	Density mol/L	C-M Function cm^3/mol expt	C-M Function cm^3/mol calc	Diff. %	Dielectric Constant expt	Dielectric Constant calc	Diff. %
16	1.000	283.200	.1489	4.00	.069	20.549	20.600	-.245	1.00425	1.00426	-.001
16	1.000	293.190	.2082	5.35	.092	20.473	20.603	-.630	1.00566	1.00570	-.004
16	1.000	303.150	.2839	7.16	.123	20.606	20.607	-.002	1.00763	1.00763	-.000
16	1.000	313.120	.3789	9.39	.162	20.653	20.611	.205	1.01004	1.01002	.002
16	1.000	323.120	.4964	12.20	.210	20.604	20.615	-.057	1.01303	1.01304	-.001
16	1.000	333.110	.6389	15.65	.269	20.618	20.620	-.010	1.01675	1.01675	-.000
16	1.000	343.080	.8093	19.86	.342	20.670	20.626	.215	1.02134	1.02129	.005
16	1.000	353.090	1.0118	25.07	.431	20.682	20.632	.238	1.02700	1.02694	.006
16	1.000	363.110	1.2495	31.54	.543	20.661	20.640	.100	1.03401	1.03398	.003
16	1.000	368.100	1.3821	35.25	.606	20.693	20.644	.237	1.03813	1.03804	.009
20	1.000	303.150	.2839	566.50	9.746	20.613	20.623	-.046	1.75424	1.75467	-.025
20	1.000	300.000	.2580	570.19	9.810	20.611	20.618	-.035	1.76031	1.76065	-.019
20	1.000	295.000	.2207	575.98	9.910	20.606	20.612	-.029	1.76975	1.77003	-.016
20	1.000	290.000	.1876	581.67	10.007	20.598	20.605	-.029	1.77898	1.77927	-.016
20	1.000	288.706	.1797	583.13	10.032	20.597	20.603	-.028	1.78137	1.78165	-.015
20	1.000	285.000	.1585	587.27	10.104	20.594	20.597	-.018	1.78823	1.78841	-.010
20	1.000	280.000	.1329	592.79	10.199	20.586	20.590	-.019	1.79724	1.79743	-.011
20	1.000	275.000	.1107	598.23	10.292	20.581	20.583	-.010	1.80626	1.80636	-.006
20	1.000	270.000	.0915	603.60	10.385	20.573	20.576	-.016	1.81504	1.81520	-.009
20	1.000	265.000	.0750	608.90	10.476	20.566	20.569	-.011	1.82385	1.82396	-.006
20	1.000	260.000	.0610	614.15	10.566	20.559	20.561	-.012	1.83253	1.83265	-.007
20	1.000	255.000	.0491	619.35	10.656	20.551	20.554	-.010	1.84117	1.84128	-.006
20	1.000	250.000	.0392	624.49	10.744	20.543	20.546	-.015	1.84967	1.84984	-.009
20	1.000	245.000	.0309	629.58	10.832	20.535	20.538	-.015	1.85818	1.85835	-.009
20	1.000	240.000	.0241	634.64	10.919	20.529	20.530	-.008	1.86671	1.86680	-.005
20	1.000	235.000	.0186	639.65	11.005	20.521	20.523	-.009	1.87511	1.87521	-.005
20	1.000	230.000	.0141	644.63	11.091	20.514	20.515	-.003	1.88354	1.88358	-.002
20	1.000	228.400	.0129	646.21	11.118	20.515	20.512	.013	1.88640	1.88625	.008
20	1.000	225.000	.0106	649.57	11.176	20.508	20.506	.007	1.89200	1.89192	.004
20	1.000	220.000	.0078	654.49	11.260	20.498	20.498	-.000	1.90021	1.90021	-.000
20	1.000	215.000	.0057	659.37	11.344	20.488	20.490	-.008	1.90840	1.90849	-.005
20	1.000	210.000	.0040	664.23	11.428	20.479	20.481	-.010	1.91661	1.91673	-.006
20	1.000	205.000	.0028	669.07	11.511	20.470	20.473	-.012	1.92482	1.92496	-.007
20	1.000	200.000	.0019	673.89	11.594	20.460	20.464	-.016	1.93297	1.93317	-.010
20	1.000	195.000	.0013	678.69	11.677	20.450	20.455	-.021	1.94109	1.94135	-.013
20	1.000	190.000	.0009	683.47	11.759	20.442	20.446	-.020	1.94928	1.94952	-.013
20	1.000	185.000	.0005	688.24	11.841	20.432	20.436	-.022	1.95741	1.95769	-.014
20	1.000	180.000	.0003	693.00	11.923	20.422	20.427	-.022	1.96556	1.96584	-.014
20	1.000	175.000	.0002	697.74	12.004	20.413	20.417	-.016	1.97377	1.97398	-.011
20	1.000	170.000	.0001	702.48	12.086	20.403	20.407	-.019	1.98187	1.98212	-.013
20	1.000	165.000	.0001	707.20	12.167	20.393	20.397	-.015	1.99005	1.99025	-.010
20	1.000	160.000	.0000	711.92	12.248	20.384	20.386	-.012	1.99821	1.99837	-.008
20	1.000	155.000	.0000	716.64	12.330	20.376	20.375	.006	2.00658	2.00650	.004
20	1.000	150.000	.0000	721.35	12.411	20.367	20.364	.016	2.01483	2.01462	.011
20	1.000	145.000	.0000	726.07	12.492	20.357	20.353	.020	2.02301	2.02274	.013
20	1.000	140.000	.0000	730.77	12.573	20.349	20.341	.039	2.03139	2.03085	.027
20	1.000	135.000	.0000	735.48	12.654	20.339	20.329	.052	2.03968	2.03896	.035

Table 13. (Continued)

Data sources and ID numbers: (16)Sliwinski, (20)Haynes, Saturated liquid, (XXXX)Haynes, Compressed Liquid.

ID	Weight	Temp. K	Pressure MPa	Density kg/m^3	Density mol/L	C-M Function cm^3/mol expt	C-M Function cm^3/mol calc	Diff. %	Dielectric Constant expt	Dielectric Constant calc	Diff. %
4302	.353	140.000	31.2779	744.53	12.809	20.287	20.282	.024	2.05326	2.05293	.016
4303	.395	140.000	27.8345	743.04	12.784	20.295	20.288	.035	2.05104	2.05054	.024
4304	.444	140.000	24.3914	741.56	12.758	20.304	20.295	.043	2.04878	2.04816	.030
4305	.497	140.000	20.9481	740.07	12.733	20.311	20.301	.048	2.04647	2.04579	.033
4306	.558	140.000	17.5051	738.59	12.707	20.318	20.308	.050	2.04412	2.04342	.034
4307	.626	140.000	14.0619	737.08	12.681	20.325	20.314	.053	2.04174	2.04099	.037
4308	.702	140.000	10.6191	735.54	12.655	20.332	20.321	.057	2.03931	2.03851	.039
4309	.787	140.000	7.1760	733.98	12.628	20.340	20.327	.060	2.03684	2.03601	.041
4310	.883	140.000	3.7333	732.44	12.601	20.346	20.334	.059	2.03435	2.03353	.040
3601	.300	160.000	36.0986	729.37	12.548	20.314	20.316	-.010	2.02636	2.02650	-.007
3602	.345	160.000	31.9664	727.45	12.516	20.324	20.324	-.003	2.02339	2.02343	-.002
3603	.395	160.000	27.8343	725.55	12.483	20.332	20.332	.001	2.02037	2.02036	.000
3604	.444	160.000	24.3911	723.90	12.454	20.340	20.339	.007	2.01780	2.01770	.005
3605	.497	160.000	20.9479	722.25	12.426	20.347	20.345	.010	2.01518	2.01505	.006
3606	.558	160.000	17.5048	720.58	12.397	20.355	20.352	.013	2.01252	2.01235	.008
3607	.626	160.000	14.0617	718.90	12.368	20.361	20.359	.012	2.00981	2.00965	.008
3608	.686	160.000	11.3074	717.55	12.345	20.366	20.364	.010	2.00760	2.00746	.007
3609	.752	160.000	8.5529	716.19	12.322	20.371	20.369	.007	2.00536	2.00527	.005
3610	.824	160.000	5.7987	714.83	12.298	20.375	20.375	.001	2.00309	2.00307	.001
3611	.883	160.000	3.7330	713.81	12.281	20.378	20.379	-.004	2.00137	2.00143	-.003
3612	.946	160.000	1.6672	712.77	12.263	20.381	20.383	-.008	1.99963	1.99974	-.005
3701	.300	180.000	36.0984	712.75	12.263	20.348	20.354	-.030	1.99744	1.99784	-.020
3702	.345	180.000	31.9664	710.65	12.226	20.358	20.362	-.024	1.99413	1.99445	-.016
3703	.395	180.000	27.8343	708.47	12.189	20.368	20.371	-.015	1.99073	1.99093	-.010
3704	.444	180.000	24.3911	706.62	12.157	20.376	20.378	-.007	1.98784	1.98794	-.005
3705	.497	180.000	20.9478	704.77	12.125	20.384	20.384	-.003	1.98490	1.98495	-.002
3706	.558	180.000	17.5047	702.90	12.093	20.391	20.391	-.002	1.98189	1.98191	-.001
3707	.626	180.000	14.0616	701.03	12.061	20.397	20.398	-.004	1.97883	1.97888	-.003
3708	.686	180.000	11.3073	699.49	12.034	20.403	20.404	-.005	1.97632	1.97639	-.003
3709	.752	180.000	8.5528	697.93	12.008	20.408	20.409	-.006	1.97377	1.97385	-.004
3710	.824	180.000	5.7986	696.33	11.980	20.413	20.415	-.007	1.97117	1.97126	-.004
3711	.883	180.000	3.7329	695.20	11.961	20.415	20.419	-.018	1.96919	1.96941	-.011
3712	.946	180.000	1.6671	694.01	11.940	20.418	20.423	-.024	1.96718	1.96749	-.016
3801	.300	200.000	36.0981	696.38	11.981	20.380	20.389	-.045	1.96911	1.96969	-.030
3802	.345	200.000	31.9662	694.00	11.940	20.390	20.397	-.035	1.96541	1.96585	-.022
3803	.395	200.000	27.8341	691.63	11.899	20.399	20.405	-.030	1.96163	1.96201	-.019
3804	.444	200.000	24.3910	689.58	11.864	20.408	20.413	-.022	1.95841	1.95868	-.014
3805	.497	200.000	20.9477	687.48	11.828	20.417	20.420	-.013	1.95510	1.95527	-.009
3806	.558	200.000	17.5047	685.38	11.792	20.424	20.427	-.013	1.95170	1.95186	-.008
3807	.626	200.000	14.0616	683.25	11.755	20.431	20.434	-.015	1.94822	1.94841	-.010
3808	.686	200.000	11.3073	681.50	11.725	20.437	20.440	-.015	1.94537	1.94555	-.009
3809	.752	200.000	8.5528	679.71	11.694	20.442	20.445	-.016	1.94245	1.94265	-.010
3810	.824	200.000	5.7986	677.89	11.663	20.448	20.451	-.017	1.93947	1.93968	-.011
3811	.883	200.000	3.7329	676.50	11.639	20.452	20.456	-.019	1.93718	1.93742	-.012
3812	.946	200.000	1.6671	675.10	11.615	20.455	20.460	-.022	1.93487	1.93515	-.014

Table 13. (Continued)

Data sources and ID numbers: (16)Sliwinski, (20)Haynes, Saturated liquid, (XXXX)Haynes, Compressed Liquid.

ID	Weight	Temp. K	Pressure MPa	Density kg/m3	Density mol/L	C-M Function cm3/mol expt	C-M Function cm3/mol calc	Diff. %	Dielectric Constant expt	Dielectric Constant calc	Diff. %
3901	.300	220.000	36.0987	680.11	11.701	20.412	20.420	-.041	1.94135	1.94185	-.026
3902	.345	220.000	31.9668	677.44	11.655	20.424	20.429	-.024	1.93723	1.93752	-.015
3903	.395	220.000	27.8346	674.72	11.608	20.435	20.438	-.012	1.93297	1.93312	-.008
3904	.444	220.000	24.3914	672.44	11.569	20.444	20.445	-.007	1.92933	1.92941	-.004
3905	.497	220.000	20.9481	670.15	11.530	20.450	20.452	-.008	1.92560	1.92570	-.005
3906	.558	220.000	17.5050	667.77	11.489	20.458	20.460	-.007	1.92176	1.92184	-.004
3907	.626	220.000	14.0618	665.30	11.446	20.467	20.467	-.001	1.91780	1.91782	-.001
3908	.686	220.000	11.3076	663.20	11.410	20.475	20.473	.011	1.91453	1.91440	.007
3909	.752	220.000	8.5530	661.11	11.374	20.483	20.479	.016	1.91118	1.91099	.010
3910	.824	220.000	5.7987	658.98	11.338	20.489	20.485	.018	1.90775	1.90753	.011
3911	.883	220.000	3.7331	657.39	11.310	20.493	20.490	.014	1.90510	1.90493	.009
3912	.946	220.000	1.6672	655.79	11.283	20.496	20.494	.007	1.90241	1.90233	.004
4001	.300	240.000	36.0977	663.98	11.424	20.436	20.449	-.068	1.91362	1.91443	-.042
4002	.345	240.000	31.9657	661.00	11.372	20.449	20.458	-.048	1.90903	1.90959	-.030
4003	.395	240.000	27.8336	657.98	11.320	20.460	20.467	-.034	1.90430	1.90470	-.021
4004	.444	240.000	24.3909	655.36	11.275	20.470	20.475	-.022	1.90020	1.90045	-.013
4005	.497	240.000	20.9473	652.66	11.229	20.481	20.483	-.007	1.89598	1.89607	-.004
4006	.558	240.000	17.5042	649.91	11.181	20.490	20.490	.001	1.89161	1.89160	.000
4007	.626	240.000	14.0611	647.07	11.133	20.500	20.498	.009	1.88710	1.88700	.005
4008	.686	240.000	11.3069	644.74	11.092	20.507	20.504	.013	1.88335	1.88320	.008
4009	.752	240.000	8.5522	642.31	11.051	20.515	20.511	.022	1.87950	1.87925	.013
4010	.824	240.000	5.7980	639.86	11.008	20.521	20.517	.021	1.87550	1.87527	.012
4011	.883	240.000	3.7324	638.00	10.976	20.525	20.522	.017	1.87244	1.87225	.010
4012	.946	240.000	1.6665	636.18	10.945	20.526	20.527	-.003	1.86928	1.86931	-.002
4101	.300	260.000	36.0979	648.02	11.149	20.458	20.476	-.090	1.88643	1.88747	-.055
4102	.345	260.000	31.9659	644.71	11.092	20.471	20.486	-.072	1.88129	1.88211	-.044
4103	.395	260.000	27.8339	641.31	11.033	20.483	20.495	-.058	1.87595	1.87661	-.035
4104	.444	260.000	24.3908	638.39	10.983	20.493	20.503	-.049	1.87134	1.87189	-.029
4105	.497	260.000	20.9475	635.35	10.931	20.503	20.511	-.038	1.86654	1.86696	-.023
4106	.558	260.000	17.5045	632.17	10.876	20.514	20.519	-.021	1.86158	1.86181	-.012
4107	.626	260.000	14.0613	628.84	10.819	20.526	20.527	-.003	1.85638	1.85642	-.002
4108	.686	260.000	11.3071	626.07	10.771	20.536	20.533	.011	1.85206	1.85194	.006
4109	.752	260.000	8.5526	623.27	10.723	20.543	20.540	.015	1.84757	1.84741	.009
4110	.824	260.000	5.7984	620.36	10.673	20.552	20.547	.023	1.84294	1.84269	.013
4111	.883	260.000	3.7328	618.17	10.635	20.555	20.552	.012	1.83928	1.83915	.007
4112	.946	260.000	1.6669	615.91	10.597	20.558	20.557	.003	1.83553	1.83550	.002
4201	.314	280.000	34.7206	630.43	10.846	20.495	20.505	-.051	1.85749	1.85805	-.030
4202	.353	280.000	31.2773	627.38	10.794	20.504	20.513	-.042	1.85268	1.85314	-.025
4203	.395	280.000	27.8338	624.17	10.739	20.515	20.521	-.029	1.84766	1.84797	-.017
4204	.444	280.000	24.3907	620.80	10.681	20.528	20.529	-.008	1.84244	1.84252	-.005
4205	.497	280.000	20.9475	617.26	10.620	20.541	20.538	.017	1.83700	1.83681	.010
4206	.558	280.000	17.5045	613.59	10.557	20.554	20.546	.038	1.83130	1.83090	.022
4207	.626	280.000	14.0614	609.80	10.491	20.565	20.555	.051	1.82533	1.82479	.029
4208	.686	280.000	11.3071	606.64	10.437	20.574	20.561	.059	1.82032	1.81970	.034

Table 13. (Continued)

Data sources and ID numbers: (16)Sliwinski, (20)Haynes, Saturated liquid, (XXXX)Haynes, Compressed Liquid.

ID	Weight	Temp. K	Pressure MPa	Density kg/m^3	Density mol/L	C-M Function cm^3/mol expt	C-M Function cm^3/mol calc	Diff. %	Dielectric Constant expt	Dielectric Constant calc	Diff. %
4209	.752	280.000	8.5526	603.39	10.381	20.580	20.568	.057	1.81507	1.81448	.032
4210	.824	280.000	5.7984	600.02	10.323	20.586	20.576	.050	1.80957	1.80906	.028
4211	.883	280.000	3.7328	597.45	10.279	20.587	20.581	.030	1.80523	1.80492	.017
4212	.946	280.000	1.6669	594.83	10.234	20.586	20.586	-.002	1.80070	1.80072	-.001
3501	.314	300.000	34.7208	614.53	10.573	20.506	20.529	-.113	1.83044	1.83164	-.065
3502	.353	300.000	31.2774	611.11	10.514	20.516	20.537	-.104	1.82505	1.82615	-.060
3503	.395	300.000	27.8340	607.49	10.452	20.527	20.545	-.088	1.81941	1.82033	-.051
3504	.444	300.000	24.3909	603.65	10.386	20.540	20.554	-.065	1.81350	1.81418	-.037
3505	.497	300.000	20.9476	599.58	10.316	20.555	20.562	-.034	1.80730	1.80764	-.019
3506	.558	300.000	17.5045	595.31	10.242	20.570	20.571	-.005	1.80075	1.80080	-.003
3507	.626	300.000	14.0613	590.90	10.166	20.582	20.580	.008	1.79380	1.79372	.004
3508	.686	300.000	11.3071	587.07	10.100	20.594	20.588	.032	1.78791	1.78759	.018
3509	.752	300.000	8.5525	583.02	10.031	20.607	20.595	.059	1.78169	1.78111	.032
3510	.824	300.000	5.7983	578.82	9.958	20.618	20.603	.071	1.77509	1.77439	.039
3511	.883	300.000	3.7326	575.64	9.904	20.620	20.609	.054	1.76984	1.76932	.029
3512	.946	300.000	1.6667	572.40	9.848	20.617	20.615	.012	1.76428	1.76416	.007

Number of data points = 152; rms deviation for CM function = 0.083%; rms deviation for dielectric constant = 0.017%.

Table 14. Comparisons with saturated liquid specific heats.

Data sources and ID numbers: (1)Aston, (2)Huffman, (3)Dana.

ID	Temp. K	C_σ, J/(mol·K) expt	calc	Diff. %
1	139.880	113.24	117.08	-3.28
1	142.220	113.45	116.95	-2.99
1	149.500	114.71	116.63	-1.65
1	156.030	116.00	116.46	-.39
1	162.290	115.92	116.42	-.43
1	168.490	116.84	116.50	.29
1	174.590	116.80	116.70	.08
1	180.830	117.09	117.04	.05
1	186.630	118.05	117.47	.50
1	191.760	118.47	117.94	.45
1	196.830	119.27	118.49	.65
1	203.240	120.10	119.30	.67
1	209.000	120.40	120.13	.22
1	215.940	121.78	121.26	.43
1	222.710	122.53	122.48	.04
1	230.810	123.91	124.09	-.15
1	238.430	124.83	125.74	-.73
1	247.010	127.00	127.75	-.58
1	251.430	129.22	128.84	.30
1	262.040	130.94	131.59	-.50
1	268.140	131.61	133.27	-1.25
2	139.700	113.55	117.09	-3.02
2	150.200	114.04	116.61	-2.20
2	152.500	114.77	116.54	-1.52
2	170.200	115.25	116.54	-1.11
2	187.000	117.69	117.50	.16
2	190.100	117.44	117.78	-.29
2	230.000	123.03	123.92	-.72
2	261.800	129.60	131.53	-1.47
3	256.950	125.973	130.246	-3.39
3	270.550	131.324	133.948	-2.00
3	277.280	135.458	135.895	-.32
3	285.020	137.647	138.227	-.42
3	289.930	139.106	139.757	-.47
3	267.020	130.594	132.957	-1.81
3	276.380	141.295	135.631	4.01
3	284.770	139.106	138.150	.69
3	289.760	140.808	139.704	.78
3	294.380	143.727	141.179	1.77

Number of data points = 39; rms deviation = 1.49%.

Table 15. Comparisons with C_v and C_p data.

C_p data of Sage [65]

P = 0.101325 MPa (1 atm)

Temp. K	C_p, J/(mol•K) expt	calc	Diff. %
294.261	95.964	99.246	-3.42
310.928	98.541	103.081	-4.61
327.594	101.314	107.088	-5.70
344.261	104.208	111.189	-6.70
360.928	107.223	115.333	-7.56
377.594	110.312	119.487	-8.32
394.261	113.400	123.625	-9.02
410.928	116.416	127.730	-9.72

Number of data points of Sage [65] = 8; rms deviation = 7.18%.

C_p^o data of Dailey [18]

Temp. K	C_p^o, J/(mol•K) expt	calc	Diff. %
344.900	110.583	110.514	.06
359.600	114.934	114.285	.56
387.500	121.754	121.392	.30
451.600	137.988	137.171	.59
521.000	154.013	153.011	.65
561.300	162.256	161.540	.44
600.800	170.331	169.420	.53
692.600	185.853	185.993	-.08

Number of data points of Dailey [18] = 8; rms deviation = 0.46%.

Table 16. Comparisons with velocity of sound data.

Saturated liquid velocities of sound from Rao [58]

Temp. K	Density kg/m^3	Vel. of Sound, m/s expt	calc	Diff. %
268.150	605.89	1085	1049	3.31
263.150	611.16	1115	1074	3.62
253.150	621.54	1173	1125	4.03
243.150	631.71	1230	1176	4.33
233.150	641.69	1286	1227	4.54
223.150	651.53	1343	1278	4.81
213.150	661.24	1400	1328	5.08
203.150	670.84	1459	1379	5.46
193.150	680.37	1515	1429	5.65
183.150	689.83	1573	1479	5.95
173.150	699.26	1630	1529	6.18
158.150	713.36	1715	1603	6.48
153.150	718.05	1743	1628	6.55
148.150	722.75	1772	1653	6.66
143.150	727.46	1800	1679	6.71

Number of data points of Rao [58] = 15; mean deviation = 5.29%.

Table 17. Calculated P(T) isochores of normal butane.

Normal Butane Isochore at 25 kg/m^3

Temp. K	Pressure MPa	Z	Isotherm Derivative MPa•m^3/kg	Isochore Derivative MPa/K	Isochore Curvature MPa/K^2
352.827	1.0063	.79753	.03014	.00465	-.0000149
360.000	1.0393	.80729	.03187	.00456	-.0000115
368.000	1.0755	.81721	.03371	.00448	-.0000091
376.000	1.1110	.82627	.03547	.00441	-.0000074
384.000	1.1461	.83461	.03719	.00436	-.0000062
392.000	1.1808	.84232	.03886	.00431	-.0000053
400.000	1.2152	.84948	.04050	.00427	-.0000046
408.000	1.2492	.85616	.04211	.00424	-.0000040
416.000	1.2830	.86241	.04370	.00421	-.0000036
424.000	1.3166	.86827	.04526	.00418	-.0000032
432.000	1.3499	.87379	.04680	.00416	-.0000028
440.000	1.3831	.87899	.04833	.00414	-.0000025
448.000	1.4161	.88390	.04984	.00412	-.0000023
456.000	1.4490	.88855	.05134	.00410	-.0000021
464.000	1.4817	.89296	.05282	.00408	-.0000019
472.000	1.5143	.89715	.05430	.00407	-.0000018
480.000	1.5468	.90113	.05576	.00406	-.0000016
488.000	1.5792	.90492	.05722	.00404	-.0000015
496.000	1.6115	.90853	.05867	.00403	-.0000014
504.000	1.6438	.91199	.06011	.00402	-.0000013
512.000	1.6759	.91529	.06154	.00401	-.0000012
520.000	1.7079	.91844	.06297	.00400	-.0000011
528.000	1.7399	.92147	.06439	.00399	-.0000010
536.000	1.7719	.92437	.06580	.00399	-.0000010
544.000	1.8037	.92715	.06721	.00398	-.0000009
552.000	1.8355	.92983	.06861	.00397	-.0000008
560.000	1.8673	.93240	.07001	.00397	-.0000008
568.000	1.8990	.93487	.07141	.00396	-.0000007
576.000	1.9306	.93725	.07280	.00395	-.0000007
584.000	1.9622	.93955	.07419	.00395	-.0000007
592.000	1.9938	.94176	.07557	.00394	-.0000006
600.000	2.0253	.94389	.07695	.00394	-.0000006
608.000	2.0568	.94596	.07833	.00393	-.0000006
616.000	2.0883	.94795	.07970	.00393	-.0000005
624.000	2.1197	.94987	.08108	.00392	-.0000005
632.000	2.1510	.95173	.08244	.00392	-.0000005
640.000	2.1824	.95353	.08381	.00392	-.0000005
648.000	2.2137	.95528	.08517	.00391	-.0000004
656.000	2.2450	95696	.08654	.00391	-.0000004
664.000	2.2763	.95860	.08789	.00391	-.0000004
672.000	2.3075	.96019	.08925	.00390	-.0000004
680.000	2.3387	.96173	.09061	.00390	-.0000004
688.000	2.3699	.96322	.09196	.00390	-.0000004
696.000	2.4011	.96467	.09331	.00389	-.0000003

Table 17. (Continued).

Normal Butane Isochore at 50 kg/m^3

Temp. K	Pressure MPa	Z	Isotherm Derivative MPa•m^3/kg	Isochore Derivative MPa/K	Isochore Curvature MPa/K^2
383.962	1.8715	.68148	.02109	.01085	-.0000535
384.000	1.8719	.68156	.02111	.01085	-.0000534
392.000	1.9572	.69808	.02354	.01050	-.0000375
400.000	2.0401	.71308	.02580	.01023	-.0000288
408.000	2.1211	.72686	.02796	.01003	-.0000232
416.000	2.2006	.73961	.03003	.00986	-.0000193
424.000	2.2789	.75147	.03204	.00972	-.0000164
432.000	2.3561	.76254	.03400	.00959	-.0000142
440.000	2.4324	.77293	.03591	.00949	-.0000124
448.000	2.5079	.78269	.03779	.00939	-.0000110
456.000	2.5828	.79190	.03964	.00931	-.0000098
464.000	2.6569	.80060	.04146	.00924	-.0000088
472.000	2.7306	.80884	.04326	.00917	-.0000079
480.000	2.8037	.81666	.04503	.00911	-.0000072
488.000	2.8763	.82409	.04679	.00906	-.0000065
496.000	2.9486	.83116	.04853	.00901	-.0000060
504.000	3.0204	.83790	.05026	.00896	-.0000055
512.000	3.0919	.84433	.05197	.00892	-.0000051
520.000	3.1631	.85048	.05366	.00888	-.0000047
528.000	3.2340	.85636	.05535	.00884	-.0000043
536.000	3.3046	.86200	.05702	.00881	-.0000040
544.000	3.3749	.86740	.05869	.00878	-.0000038
552.000	3.4450	.87258	.06034	.00875	-.0000035
560.000	3.5149	.87757	.06199	.00872	-.0000033
568.000	3.5846	.88235	.06363	.00870	-.0000031
576.000	3.6541	.88696	.06526	.00867	-.0000029
584.000	3.7233	.89140	.06688	.00865	-.0000027
592.000	3.7925	.89567	.06850	.00863	-.0000026
600.000	3.8614	.89980	.07011	.00861	-.0000024
608.000	3.9302	.90378	.07171	.00859	-.0000023
616.000	3.9988	.90762	.07331	.00857	-.0000022
624.000	4.0673	.91133	.07490	.00855	-.0000021
632.000	4.1357	.91492	.07649	.00854	-.0000020
640.000	4.2039	.91839	.07807	.00852	-.0000019
648.000	4.2721	.92175	.07965	.00851	-.0000018
656.000	4.3401	.92501	.08123	.00849	-.0000017
664.000	4.4080	.92816	.08280	.00848	-.0000016
672.000	4.4758	.93122	.08436	.00847	-.0000016
680.000	4.5435	.93418	.08592	.00846	-.0000015
688.000	4.6111	.93705	.08748	.00844	-.0000014
696.000	4.6786	.93984	.08904	.00843	-.0000014

Table 17. (Continued).

Normal Butane Isochore at 100 kg/m^3

Temp. K	Pressure MPa	Z	Isotherm Derivative MPa•m^3/kg	Isochore Derivative MPa/K	Isochore Curvature MPa/K^2
411.953	3.0475	.51715	.00819	.02600	-.0002358
416.000	3.1511	.52952	.00973	.02523	-.0001567
424.000	3.3487	.55212	.01245	.02426	-.0000967
432.000	3.5400	.57286	.01499	.02360	-.0000705
440.000	3.7268	.59211	.01742	.02310	-.0000554
448.000	3.9100	.61012	.01978	.02270	-.0000455
456.000	4.0902	.62705	.02209	.02237	-.0000384
464.000	4.2680	.64302	.02435	.02208	-.0000330
472.000	4.4437	.65814	.02659	.02184	-.0000288
480.000	4.6175	.67249	.02880	.02162	-.0000255
488.000	4.7896	.68613	.03098	.02143	-.0000227
496.000	4.9604	.69912	.03315	.02126	-.0000205
504.000	5.1298	.71152	.03530	.02110	-.0000185
512.000	5.2980	.72337	.03743	.02096	-.0000169
520.000	5.4651	.73472	.03954	.02083	-.0000154
528.000	5.6313	.74558	.04165	.02071	-.0000142
536.000	5.7965	.75601	.04374	.02060	-.0000131
544.000	5.9609	.76601	.04582	.02050	-.0000121
552.000	6.1246	.77564	.04789	.02041	-.0000113
560.000	6.2875	.78489	.04996	.02032	-.0000105
568.000	6.4497	.79380	.05201	.02024	-.0000098
576.000	6.6113	.80239	.05406	.02016	-.0000092
584.000	6.7723	.81067	.05609	.02009	-.0000087
592.000	6.9328	.81867	.05813	.02002	-.0000082
600.000	7.0927	.82639	.06015	.01996	-.0000077
608.000	7.2522	.83385	.06217	.01990	-.0000073
616.000	7.4111	.84106	.06418	.01984	-.0000069
624.000	7.5697	.84804	.06619	.01979	-.0000066
632.000	7.7278	.85479	.06819	.01974	-.0000062
640.000	7.8855	.86133	.07018	.01969	-.0000059
648.000	8.0428	.86767	.07217	.01964	-.0000057
656.000	8.1998	.87382	.07416	.01960	-.0000054
664.000	8.3564	.87978	.07614	.01956	-.0000052
672.000	8.5127	.88556	.07812	.01952	-.0000050
680.000	8.6687	.89118	.08009	.01948	-.0000048
688.000	8.8244	.89664	.08206	.01944	-.0000046
696.000	8.9797	.90194	.08402	.01940	-.0000044

Table 17. (Continued).

Normal Butane Isochore at 150 kg/m^3

Temp. K	Pressure MPa	Z	Isotherm Derivative MPa•m^3/kg	Isochore Derivative MPa/K	Isochore Curvature MPa/K^2
422.276	3.6171	.39921	.00196	.04259	-.0008688
424.000	3.6895	.40554	.00263	.04154	-.0004513
432.000	4.0125	.43287	.00528	.03954	-.0001571
440.000	4.3245	.45805	.00780	.03855	-.0000994
448.000	4.6300	.48165	.01030	.03787	-.0000734
456.000	4.9308	.50394	.01279	.03735	-.0000583
464.000	5.2278	.52509	.01528	.03692	-.0000482
472.000	5.5217	.54521	.01776	.03657	-.0000411
480.000	5.8130	.56440	.02025	.03626	-.0000357
488.000	6.1020	.58275	.02274	.03599	-.0000314
496.000	6.3890	.60031	.02523	.03576	-.0000280
504.000	6.6741	.61716	.02773	.03554	-.0000253
512.000	6.9577	.63332	.03022	.03535	-.0000229
520.000	7.2398	.64886	.03271	.03517	-.0000210
528.000	7.5205	.66381	.03521	.03501	-.0000193
536.000	7.8000	.67821	.03770	.03486	-.0000179
544.000	8.0784	.69208	.04019	.03473	-.0000166
552.000	8.3557	.70546	.04268	.03460	-.0000155
560.000	8.6320	.71838	.04518	.03448	-.0000145
568.000	8.9073	.73085	.04767	.03437	-.0000137
576.000	9.1818	.74291	.05016	.03426	-.0000129
584.000	9.4555	.75457	.05264	.03416	-.0000122
592.000	9.7284	.76586	.05513	.03406	-.0000116
600.000	10.0005	.77679	.05762	.03397	-.0000110
608.000	10.2720	.78737	.06010	.03389	-.0000105
616.000	10.5428	.79763	.06258	.03381	-.0000100
624.000	10.8129	.80758	.06506	.03373	-.0000096
632.000	11.0824	.81723	.06754	.03365	-.0000092
640.000	11.3513	.82660	.07002	.03358	-.0000089
648.000	11.6197	.83570	.07249	.03351	-.0000085
656.000	11.8875	.84453	.07497	.03344	-.0000082
664.000	12.1548	.85312	.07744	.03338	-.0000079
672.000	12.4215	.86146	.07990	.03332	-.0000077
680.000	12.6878	.86958	.08237	.03326	-.0000074
688.000	12.9536	.87747	.08483	.03320	-.0000072
696.000	13.2190	.88515	.08729	.03314	-.0000070

Table 17. (Continued).

Normal Butane Isochore at 200 kg/m^3

Temp. K	Pressure MPa	Z	Isotherm Derivative MPa•m^3/kg	Isochore Derivative MPa/K	Isochore Curvature MPa/K^2
425.033	3.7879	.31150	.00008	.05803	-.0067339
432.000	4.1771	.33797	.00216	.05516	-.0001184
440.000	4.6154	.36665	.00475	.05449	-.0000628
448.000	5.0496	.39398	.00747	.05407	-.0000441
456.000	5.4809	.42012	.01026	.05376	-.0000345
464.000	5.9099	.44520	.01311	.05351	-.0000286
472.000	6.3371	.46929	.01601	.05330	-.0000246
480.000	6.7628	.49246	.01896	.05311	-.0000218
488.000	7.1870	.51478	.02193	.05295	-.0000196
496.000	7.6100	.53628	.02494	.05280	-.0000179
504.000	8.0318	.55702	.02796	.05266	-.0000165
512.000	8.4526	.57705	.03101	.05253	-.0000154
520.000	8.8724	.59639	.03408	.05241	-.0000145
528.000	9.2912	.61508	.03716	.05230	-.0000138
536.000	9.7092	.63315	.04026	.05219	-.0000131
544.000	10.1263	.65065	.04337	.05209	-.0000126
552.000	10.5426	.66758	.04649	.05199	-.0000121
560.000	10.9582	.68398	.04962	.05190	-.0000117
568.000	11.3730	.69987	.05275	.05181	-.0000113
576.000	11.7871	.71528	.05589	.05172	-.0000110
584.000	12.2005	.73022	.05904	.05163	-.0000107
592.000	12.6132	.74472	.06220	.05155	-.0000104
600.000	13.0252	.75880	.06535	.05146	-.0000102
608.000	13.4366	.77246	.06852	.05138	-.0000100
616.000	13.8474	.78574	.07168	.05130	-.0000098
624.000	14.2575	.79864	.07485	.05123	-.0000096
632.000	14.6670	.81118	.07801	.05115	-.0000094
640.000	15.0759	.82337	.08118	.05108	-.0000092
648.000	15.4842	.83523	.08435	.05100	-.0000091
656.000	15.8920	.84677	.08752	.05093	-.0000090
664.000	16.2991	.85800	.09070	.05086	-.0000088
672.000	16.7057	.86894	.09387	.05079	-.0000087
680.000	17.1118	.87958	.09704	.05072	-.0000086
688.000	17.5172	.88996	.10021	.05065	-.0000085
696.000	17.9222	.90006	.10337	.05058	-.0000084

Table 17. (Continued).

Normal Butane Isochore at 227.847 kg/m^3

Temp. K	Pressure MPa	Z	Isotherm Derivative MPa•m^3/kg	Isochore Derivative MPa/K	Isochore Curvature MPa/K^2
425.160	3.7960	.27394	.00000	.06427	-.0000000
432.000	4.2356	.30082	.00216	.06427	-.0000007
440.000	4.7497	.33120	.00505	.06426	-.0000014
448.000	5.2638	.36049	.00811	.06425	-.0000021
456.000	5.7777	.38875	.01128	.06423	-.0000028
464.000	6.2914	.41601	.01453	.06420	-.0000034
472.000	6.8049	.44234	.01786	.06417	-.0000039
480.000	7.3182	.46778	.02123	.06414	-.0000044
488.000	7.8311	.49236	.02466	.06410	-.0000048
496.000	8.3438	.51613	.02812	.06406	-.0000052
504.000	8.8561	.53913	.03161	.06402	-.0000056
512.000	9.3681	.56138	.03514	.06397	-.0000060
520.000	9.8797	.58293	.03869	.06392	-.0000063
528.000	10.3909	.60380	.04226	.06387	-.0000066
536.000	10.9017	.62403	.04585	.06382	-.0000068
544.000	11.4120	.64364	.04945	.06376	-.0000071
552.000	11.9219	.66265	.05307	.06371	-.0000073
560.000	12.4313	.68109	.05670	.06365	-.0000075
568.000	12.9402	.69899	.06035	.06359	-.0000077
576.000	13.4486	.71636	.06400	.06352	-.0000079
584.000	13.9566	.73324	.06766	.06346	-.0000080
592.000	14.4640	.74963	.07133	.06340	-.0000081
600.000	14.9709	.76555	.07501	.06333	-.0000083
608.000	15.4773	.78103	.07869	.06326	-.0000084
616.000	15.9831	.79608	.08237	.06320	-.0000085
624.000	16.4884	.81072	.08606	.06313	-.0000085
632.000	16.9931	.82496	.08975	.06306	-.0000086
640.000	17.4973	.83882	.09344	.06299	-.0000087
648.000	18.0010	.85231	.09714	.06292	-.0000087
656.000	18.5041	.86545	.10083	.06285	-.0000088
664.000	19.0066	.87824	.10453	.06278	-.0000088
672.000	19.5085	.89070	.10822	.06271	-.0000089
680.000	20.0099	.90285	.11192	.06264	-.0000089
688.000	20.5108	.91468	.11562	.06257	-.0000089
696.000	21.0110	.92622	.11931	.06250	-.0000089

Table 17. (Continued).

Normal Butane Isochore at 250 kg/m^3

Temp. K	Pressure MPa	Z	Isotherm Derivative MPa•m^3/kg	Isochore Derivative MPa/K	Isochore Curvature MPa/K^2
425.087	3.7913	.24940	.00005	.06934	.0121526
432.000	4.2872	.27751	.00258	.07243	.0001153
440.000	4.8695	.30947	.00588	.07307	.0000587
448.000	5.4557	.34053	.00936	.07345	.0000389
456.000	6.0445	.37066	.01297	.07372	.0000283
464.000	6.6351	.39986	.01668	.07392	.0000213
472.000	7.2270	.42815	.02046	.07407	.0000164
480.000	7.8200	.45556	.02431	.07418	.0000126
488.000	8.4139	.48212	.02820	.07427	.0000096
496.000	9.0083	.50786	.03214	.07434	.0000071
504.000	9.6032	.53280	.03612	.07438	.0000050
512.000	10.1984	.55698	.04012	.07442	.0000032
520.000	10.7938	.58043	.04416	.07444	.0000017
528.000	11.3893	.60318	.04822	.07444	.0000004
536.000	11.9849	.62525	.05230	.07444	-.0000007
544.000	12.5804	.64666	.05641	.07443	-.0000018
552.000	13.1758	.66745	.06052	.07442	-.0000027
560.000	13.7710	.68764	.06465	.07439	-.0000035
568.000	14.3660	.70725	.06880	.07436	-.0000042
576.000	14.9608	.72630	.07295	.07432	-.0000048
584.000	15.5552	.74481	.07711	.07428	-.0000054
592.000	16.1493	.76280	.08128	.07424	-.0000059
600.000	16.7430	.78030	.08546	.07419	-.0000064
608.000	17.3363	.79732	.08964	.07414	-.0000068
616.000	17.9292	.81388	.09383	.07408	-.0000072
624.000	18.5216	.82999	.09802	.07402	-.0000075
632.000	19.1135	.84568	.10221	.07396	-.0000078
640.000	19.7049	.86095	.10641	.07389	-.0000081
648.000	20.2958	.87582	.11060	.07383	-.0000084
656.000	20.8862	.89030	.11480	.07376	-.0000086
664.000	21.4760	.90441	.11900	.07369	-.0000088
672.000	22.0652	.91816	.12320	.07362	-.0000090
680.000	22.6539	.93157	.12740	.07355	-.0000092
688.000	23.2420	.94464	.13159	.07347	-.0000093
696.000	23.8295	.95738	.13579	.07340	-.0000094

Table 17. (Continued).

Normal Butane Isochore at 300 kg/m^3

Temp. K	Pressure MPa	Z	Isotherm Derivative MPa•m^3/kg	Isochore Derivative MPa/K	Isochore Curvature MPa/K^2
423.093	3.6667	.20195	.00245	.09168	.0018610
424.000	3.7505	.20612	.00309	.09299	.0011452
432.000	4.5150	.24354	.00815	.09724	.0002997
440.000	5.3009	.28073	.01321	.09907	.0001797
448.000	6.0985	.31721	.01837	.10028	.0001277
456.000	6.9045	.35283	.02361	.10117	.0000975
464.000	7.7167	.38754	.02893	.10186	.0000774
472.000	8.5340	.42132	.03430	.10242	.0000627
480.000	9.3552	.45416	.03972	.10288	.0000515
488.000	10.1798	.48609	.04518	.10325	.0000427
496.000	11.0071	.51712	.05068	.10356	.0000354
504.000	11.8367	.54727	.05621	.10382	.0000294
512.000	12.6682	.57656	.06177	.10404	.0000243
520.000	13.5012	.60502	.06735	.10421	.0000199
528.000	14.3355	.63267	.07295	.10436	.0000161
536.000	15.1708	.65954	.07856	.10447	.0000128
544.000	16.0070	.68566	.08419	.10456	.0000099
552.000	16.8437	.71105	.08983	.10463	.0000073
560.000	17.6810	.73573	.09548	.10468	.0000050
568.000	18.5186	.75973	.10114	.10471	.0000030
576.000	19.3563	.78307	.10680	.10473	.0000012
584.000	20.1942	.80578	.11247	.10473	-.0000004
592.000	21.0320	.82787	.11814	.10472	-.0000019
600.000	21.8697	.84936	.12381	.10470	-.0000032
608.000	22.7072	.87028	.12949	.10467	-.0000044
616.000	23.5444	.89065	.13517	.10463	-.0000055
624.000	24.3813	.91048	.14084	.10458	-.0000065
632.000	25.2177	.92980	.14652	.10453	-.0000074
640.000	26.0537	.94862	.15219	.10447	-.0000082
648.000	26.8892	.96695	.15786	.10440	-.0000089
656.000	27.7241	.98481	.16353	.10432	-.0000096
664.000	28.5583	1.00222	.16919	.10424	-.0000102
672.000	29.3920	1.01920	.17485	.10416	-.0000107
680.000	30.2249	1.03575	.18050	.10407	-.0000112
688.000	31.0571	1.05190	.18615	.10398	-.0000117
696.000	31.8886	1.06764	.19180	.10389	-.0000121

Table 17. (Continued).

Normal Butane Isochore at 350 kg/m^3

Temp. K	Pressure MPa	Z	Isotherm Derivative MPa•m^3/kg	Isochore Derivative MPa/K	Isochore Curvature MPa/K^2
416.274	3.2745	.15711	.01512	.13054	.0008352
424.000	4.3018	.20265	.02334	.13489	.0004029
432.000	5.3921	.24930	.03142	.13749	.0002656
440.000	6.4997	.29505	.03937	.13931	.0001961
448.000	7.6200	.33973	.04728	.14070	.0001528
456.000	8.7501	.38327	.05516	.14179	.0001228
464.000	9.8881	.42565	.06304	.14268	.0001005
472.000	11.0326	.46686	.07091	.14341	.0000831
480.000	12.1824	.50693	.07878	.14402	.0000691
488.000	13.3366	.54586	.08664	.14453	.0000576
496.000	14.4946	.58368	.09451	.14495	.0000480
504.000	15.6556	.62043	.10238	.14530	.0000398
512.000	16.8192	.65613	.11024	.14559	.0000328
520.000	17.9849	.69081	.11810	.14583	.0000267
528.000	19.1523	.72450	.12595	.14602	.0000214
536.000	20.3211	.75724	.13380	.14617	.0000167
544.000	21.4909	.78906	.14164	.14628	.0000125
552.000	22.6615	.81998	.14947	.14637	.0000088
560.000	23.8327	.85004	.15730	.14643	.0000055
568.000	25.0043	.87927	.16512	.14646	.0000026
576.000	26.1760	.90768	.17293	.14647	-.0000001
584.000	27.3478	.93532	.18073	.14646	-.0000024
592.000	28.5193	.96221	.18851	.14643	-.0000046
600.000	29.6906	.98837	.19629	.14639	-.0000065
608.000	30.8615	1.01383	.20406	.14633	-.0000083
616.000	32.0318	1.03861	.21181	.14625	-.0000099
624.000	33.2015	1.06274	.21956	.14617	-.0000113
632.000	34.3705	1.08623	.22729	.14607	-.0000126
640.000	35.5386	1.10911	.23501	.14597	-.0000138
648.000	36.7059	1.13140	.24271	.14585	-.0000149
656.000	37.8723	1.15311	.25040	.14573	-.0000159
664.000	39.0376	1.17427	.25808	.14560	-.0000167
672.000	40.2018	1.19490	.26574	.14546	-.0000176
680.000	41.3650	1.21500	.27339	.14532	-.0000183
688.000	42.5269	1.23461	.28103	.14517	-.0000190
696.000	43.6877	1.25373	.28865	.14502	-.0000196

Table 17. (Continued).

Normal Butane Isochore at 400 kg/m^3

Temp. K	Pressure MPa	Z	Isotherm Derivative MPa•m^3/kg	Isochore Derivative MPa/K	Isochore Curvature MPa/K^2
402.840	2.6135	.11338	.04987	.19052	.0004716
408.000	3.6023	.15431	.05801	.19265	.0003636
416.000	5.1540	.21653	.07021	.19513	.0002653
424.000	6.7228	.27710	.08210	.19699	.0002049
432.000	8.3048	.33597	.09378	.19846	.0001630
440.000	9.8973	.39312	.10532	.19963	.0001320
448.000	11.4983	.44856	.11676	.20059	.0001078
456.000	13.1062	.50231	.12810	.20137	.0000884
464.000	14.7198	.55443	.13937	.20201	.0000725
472.000	16.3380	.60495	.15057	.20253	.0000591
480.000	17.9601	.65393	.16172	.20296	.0000477
488.000	19.5852	.70141	.17281	.20330	.0000379
496.000	21.2127	.74744	.18386	.20357	.0000295
504.000	22.8421	.79208	.19486	.20378	.0000221
512.000	24.4730	.83537	.20581	.20393	.0000155
520.000	26.1048	.87736	.21673	.20403	.0000098
528.000	27.7373	.91810	.22760	.20408	.0000047
536.000	29.3701	.95764	.23844	.20410	.0000001
544.000	31.0029	.99601	.24924	.20409	-.0000039
552.000	32.6354	1.03326	.26000	.20404	-.0000076
560.000	34.2674	1.06944	.27073	.20397	-.0000108
568.000	35.8988	1.10457	.28142	.20387	-.0000138
576.000	37.5293	1.13870	.29208	.20375	-.0000164
584.000	39.1587	1.17186	.30271	.20361	-.0000188
592.000	40.7869	1.20410	.31330	.20345	-.0000210
600.000	42.4138	1.23543	.32387	.20327	-.0000229
608.000	44.0392	1.26590	.33440	.20308	-.0000247
616.000	45.6631	1.29553	.34490	.20288	-.0000263
624.000	47.2852	1.32435	.35537	.20266	-.0000277
632.000	48.9056	1.35239	.36580	.20243	-.0000290
640.000	50.5241	1.37969	.37621	.20220	-.0000302
648.000	52.1407	1.40625	.38659	.20195	-.0000313
656.000	53.7553	1.43212	.39694	.20170	-.0000322
664.000	55.3679	1.45731	.40726	.20144	-.0000331
672.000	56.9783	1.48184	.41755	.20117	-.0000338
680.000	58.5865	1.50574	.42781	.20089	-.0000345
688.000	60.1926	1.52903	.43804	.20062	-.0000351
696.000	61.7964	1.55173	.44825	.20033	-.0000357

Table 17. (Continued).

Normal Butane Isochore at 450 kg/m^3

Temp. K	Pressure MPa	Z	Isotherm Derivative MPa•m^3/kg	Isochore Derivative MPa/K	Isochore Curvature MPa/K^2
381.922	1.8022	.07331	.12106	.27769	.0002405
384.000	2.3797	.09627	.12558	.27817	.0002239
392.000	4.6117	.18276	.14270	.27975	.0001731
400.000	6.8547	.26622	.15946	.28097	.0001358
408.000	9.1065	.34674	.17592	.28194	.0001069
416.000	11.3652	.42442	.19215	.28270	.0000837
424.000	13.6293	.49936	.20819	.28329	.0000646
432.000	15.8975	.57168	.22405	.28374	.0000486
440.000	18.1688	.64148	.23975	.28407	.0000350
448.000	20.4424	.70886	.25532	.28431	.0000233
456.000	22.7175	.77394	.27077	.28445	.0000131
464.000	24.9934	.83679	.28609	.28452	.0000042
472.000	27.2697	.89753	.30132	.28452	-.0000036
480.000	29.5457	.95623	.31644	.28447	-.0000105
488.000	31.8210	1.01298	.33146	.28436	-.0000166
496.000	34.0952	1.06788	.34640	.28420	-.0000220
504.000	36.3681	1.12098	.36125	.28401	-.0000269
512.000	38.6392	1.17238	.37602	.28377	-.0000312
520.000	40.9084	1.22213	.39072	.28351	-.0000351
528.000	43.1753	1.27031	.40533	.28321	-.0000385
536.000	45.4397	1.31698	.41988	.28289	-.0000416
544.000	47.7015	1.36220	.43436	.28255	-.0000444
552.000	49.9605	1.40604	.44877	.28218	-.0000469
560.000	52.2164	1.44853	.46311	.28180	-.0000491
568.000	54.4692	1.48974	.47739	.28140	-.0000511
576.000	56.7187	1.52972	.49161	.28098	-.0000529
584.000	58.9649	1.56852	.50576	.28055	-.0000545
592.000	61.2076	1.60617	.51986	.28011	-.0000559
600.000	63.4466	1.64273	.53390	.27966	-.0000571
608.000	65.6821	1.67823	.54789	.27920	-.0000583
616.000	67.9138	1.71272	.56182	.27873	-.0000592
624.000	70.1417	1.74623	.57569	.27825	-.0000601

Table 17. (Continued).

Normal Butane Isochore at 500 kg/m^3

Temp. K	Pressure MPa	Z	Isotherm Derivative MPa•m^3/kg	Isochore Derivative MPa/K	Isochore Curvature MPa/K^2
353.249	1.0155	.04019	.24622	.40030	.0000067
356.000	2.1169	.08314	.25413	.40031	.0000020
360.000	3.7181	.14440	.26554	.40030	-.0000045
364.000	5.3193	.20432	.27686	.40027	-.0000106
368.000	6.9203	.26292	.28810	.40022	-.0000164
372.000	8.5210	.32026	.29925	.40014	-.0000218
376.000	10.1214	.37636	.31033	.40004	-.0000270
380.000	11.7213	.43127	.32134	.39993	-.0000319
384.000	13.3208	.48501	.33227	.39979	-.0000366
388.000	14.9196	.53762	.34315	.39963	-.0000410
392.000	16.5178	.58914	.35396	.39946	-.0000452
396.000	18.1153	.63959	.36471	.39927	-.0000492
400.000	19.7120	.68900	.37540	.39907	-.0000529
404.000	21.3078	.73741	.38604	.39885	-.0000565
408.000	22.9027	.78484	.39662	.39862	-.0000599
412.000	24.4967	.83131	.40715	.39837	-.0000631
416.000	26.0897	.87685	.41764	.39811	-.0000661
420.000	27.6816	.92150	.42807	.39784	-.0000690
424.000	29.2724	.96526	.43846	.39756	-.0000718
428.000	30.8621	1.00817	.44880	.39727	-.0000743
432.000	32.4505	1.05024	.45910	.39697	-.0000768
436.000	34.0378	1.09151	.46936	.39665	-.0000791
440.000	35.6237	1.13198	.47958	.39633	-.0000813
444.000	37.2084	1.17168	.48975	.39600	-.0000834
448.000	38.7918	1.21063	.49989	.39567	-.0000854
452.000	40.3737	1.24886	.50999	.39532	-.0000872
456.000	41.9543	1.28636	.52005	.39497	-.0000890
460.000	43.5335	1.32317	.53007	.39461	-.0000906
464.000	45.1112	1.35931	.54006	.39424	-.0000922
468.000	46.6874	1.39478	.55002	.39387	-.0000937
472.000	48.2621	1.42961	.55994	.39349	-.0000950
476.000	49.8353	1.46380	.56983	.39311	-.0000964
480.000	51.4070	1.49738	.57968	.39272	-.0000976
484.000	52.9771	1.53036	.58951	.39233	-.0000987
488.000	54.5457	1.56276	.59930	.39193	-.0000998
492.000	56.1126	1.59458	.60906	.39153	-.0001008
496.000	57.6779	1.62585	.61879	.39113	-.0001018
500.000	59.2416	1.65656	.62849	.39072	-.0001027
504.000	60.8036	1.68675	.63816	.39031	-.0001035
508.000	62.3640	1.71641	.64781	.38989	-.0001043
512.000	63.9228	1.74557	.65742	.38947	-.0001050
516.000	65.4798	1.77423	.66701	.38905	-.0001057
520.000	67.0352	1.80240	.67657	.38863	-.0001063
524.000	68.5888	1.83009	.68610	.38820	-.0001069
528.000	70.1407	1.85733	.69561	.38777	-.0001074
532.000	71.6910	1.88410	.70509	.38734	-.0001079

Table 17. (Continued).

Normal Butane Isochore at 550 kg/m^3

Temp. K	Pressure MPa	Z	Isotherm Derivative MPa•m^3/kg	Isochore Derivative MPa/K	Isochore Curvature MPa/K^2
316.955	.4215	.01690	.44649	.57026	-.0003178
320.000	2.1566	.08566	.45781	.56931	-.0003082
324.000	4.4314	.17384	.47261	.56810	-.0002970
328.000	6.7015	.25969	.48732	.56693	-.0002875
332.000	8.9670	.34329	.50195	.56580	-.0002792
336.000	11.2279	.42474	.51650	.56470	-.0002720
340.000	13.4846	.50410	.53096	.56362	-.0002657
344.000	15.7370	.58146	.54535	.56257	-.0002603
348.000	17.9852	.65689	.55966	.56154	-.0002555
352.000	20.2293	.73046	.57389	.56053	-.0002514
356.000	22.4694	.80223	.58806	.55953	-.0002477
360.000	24.7055	.87227	.60214	.55854	-.0002444
364.000	26.9378	.94063	.61616	.55757	-.0002416
368.000	29.1661	1.00737	.63011	.55661	-.0002390
372.000	31.3907	1.07255	.64399	.55566	-.0002367
376.000	33.6114	1.13621	.65781	.55472	-.0002347
380.000	35.8284	1.19840	.67156	.55378	-.0002328
384.000	38.0417	1.25918	.68525	.55285	-.0002312
388.000	40.2513	1.31858	.69888	.55193	-.0002297
392.000	42.4571	1.37665	.71244	.55102	-.0002283
396.000	44.6594	1.43343	.72595	.55011	-.0002270
400.000	46.8580	1.48896	.73940	.54920	-.0002258
404.000	49.0530	1.54327	.75279	.54830	-.0002247
408.000	51.2444	1.59641	.76613	.54740	-.0002237
412.000	53.4322	1.64841	.77941	.54651	-.0002228
416.000	55.6165	1.69930	.79264	.54562	-.0002219
420.000	57.7972	1.74911	.80582	.54473	-.0002210
424.000	59.9744	1.79787	.81894	.54385	-.0002202
428.000	62.1480	1.84562	.83202	.54297	-.0002193
432.000	64.3181	1.89238	.84504	.54210	-.0002186
436.000	66.4848	1.93818	.85802	.54122	-.0002178
440.000	68.6479	1.98305	.87095	.54035	-.0002171
444.000	70.8076	2.02701	.88383	.53949	-.0002163

Normal Butane Isochore at 600 kg/m^3

273.655	.1053	.00448	.74460	.80593	-.0008644
276.000	1.9925	.08411	.75571	.80394	-.0008386
280.000	5.2016	.21645	.77460	.80066	-.0007986
284.000	8.3980	.34453	.79341	.79754	-.0007630
288.000	11.5821	.46856	.81216	.79456	-.0007311
292.000	14.7546	.58873	.83082	.79169	-.0007024
296.000	17.9158	.70520	.84940	.78893	-.0006766
300.000	21.0662	.81815	.86790	.78627	-.0006534
304.000	24.2061	.92773	.88632	.78370	-.0006323
308.000	27.3359	1.03408	.90465	.78121	-.0006131
312.000	30.4559	1.13733	.92290	.77880	-.0005957
316.000	33.5664	1.23762	.94107	.77644	-.0005797
320.000	36.6675	1.33506	.95915	.77416	-.0005652
324.000	39.7597	1.42978	.97716	.77192	-.0005517
328.000	42.8430	1.52187	.99508	.76974	-.0005394
332.000	45.9177	1.61143	1.01291	.76761	-.0005280
336.000	48.9839	1.69857	1.03067	.76551	-.0005174
340.000	52.0418	1.78338	1.04835	.76346	-.0005076
344.000	55.0917	1.86594	1.06595	.76145	-.0004985
348.000	58.1335	1.94633	1.08347	.75948	-.0004900
352.000	61.1675	2.02464	1.10091	.75753	-.0004820
356.000	64.1938	2.10094	1.11827	.75562	-.0004745
360.000	67.2125	2.17529	1.13556	.75374	-.0004675
364.000	70.2237	2.24777	1.15278	.75188	-.0004609

Table 17. (Continued).

Normal Butane Isochore at 650 kg/m^3

Temp. K	Pressure MPa	Z	Isotherm Derivative MPa•m^3/kg	Isochore Derivative MPa/K	Isochore Curvature MPa/K^2
224.711	.0104	.00050	1.16166	1.13762	-.0019286
226.000	1.4747	.07018	1.16929	1.13515	-.0018906
228.000	3.7413	.17648	1.18115	1.13143	-.0018345
230.000	6.0005	.28059	1.19300	1.12781	-.0017816
232.000	8.2526	.38257	1.20484	1.12430	-.0017316
234.000	10.4978	.48249	1.21668	1.12089	-.0016845
236.000	12.7362	.58041	1.22851	1.11756	-.0016399
238.000	14.9681	.67639	1.24033	1.11432	-.0015977
240.000	17.1936	.77048	1.25214	1.11117	-.0015578
242.000	19.4128	.86274	1.26394	1.10809	-.0015199
244.000	21.6260	.95322	1.27572	1.10509	-.0014841
246.000	23.8332	1.04197	1.28748	1.10215	-.0014500
248.000	26.0347	1.12904	1.29923	1.09929	-.0014177
250.000	28.2304	1.21447	1.31096	1.09648	-.0013869
252.000	30.4206	1.29830	1.32268	1.09374	-.0013577
254.000	32.6054	1.38059	1.33437	1.09105	-.0013298
256.000	34.7849	1.46136	1.34604	1.08842	-.0013033
258.000	36.9591	1.54067	1.35770	1.08584	-.0012781
260.000	39.1283	1.61855	1.36933	1.08331	-.0012539
262.000	41.2924	1.69503	1.38094	1.08082	-.0012309
264.000	43.4516	1.77015	1.39253	1.07838	-.0012089
266.000	45.6059	1.84394	1.40410	1.07598	-.0011879
268.000	47.7555	1.91645	1.41564	1.07363	-.0011678
270.000	49.9005	1.98769	1.42716	1.07131	-.0011485
272.000	52.0408	2.05771	1.43866	1.06903	-.0011301
274.000	54.1766	2.12652	1.45013	1.06679	-.0011124
276.000	56.3080	2.19416	1.46158	1.06458	-.0010954
278.000	58.4350	2.26067	1.47300	1.06241	-.0010791
280.000	60.5577	2.32605	1.48441	1.06027	-.0010635
282.000	62.6761	2.39035	1.49578	1.05816	-.0010485
284.000	64.7903	2.45358	1.50713	1.05607	-.0010340
286.000	66.9004	2.51577	1.51846	1.05402	-.0010201
288.000	69.0064	2.57694	1.52976	1.05199	-.0010066
290.000	71.1084	2.63713	1.54103	1.04999	-.0009937

Normal Butane Isochore at 700 kg/m^3

172.361	.0002	.00001	1.72229	1.62029	-.0043399
174.000	2.6501	.15210	1.73404	1.61329	-.0042017
176.000	5.8684	.33299	1.74843	1.60505	-.0040433
178.000	9.0705	.50890	1.76287	1.59711	-.0038954
180.000	12.2570	.68004	1.77737	1.58946	-.0037570
182.000	15.4285	.84660	1.79191	1.58208	-.0036275
184.000	18.5855	1.00874	1.80648	1.57495	-.0035061
186.000	21.7284	1.16665	1.82107	1.56805	-.0033923
188.000	24.8578	1.32047	1.83569	1.56137	-.0032853
190.000	27.9741	1.47037	1.85033	1.55490	-.0031847
192.000	31.0776	1.61648	1.86498	1.54863	-.0030901
194.000	34.1687	1.75894	1.87964	1.54254	-.0030009
196.000	37.2478	1.89788	1.89430	1.53662	-.0029168
198.000	40.3153	2.03343	1.90897	1.53087	-.0028374
200.000	43.3714	2.16569	1.92363	1.52527	-.0027624
202.000	46.4165	2.29480	1.93828	1.51982	-.0026914
204.000	49.4508	2.42084	1.95293	1.51450	-.0026243
206.000	52.4746	2.54393	1.96757	1.50932	-.0025606
208.000	55.4881	2.66416	1.98219	1.50426	-.0025002
210.000	58.4917	2.78162	1.99680	1.49931	-.0024429
212.000	61.4855	2.89641	2.01139	1.49448	-.0023884
214.000	64.4697	3.00861	2.02596	1.48976	-.0023366
216.000	67.4446	3.11829	2.04051	1.48514	-.0022873
218.000	70.4103	3.22555	2.05504	1.48061	-.0022403

Table 17. (Continued).

Normal Butane Isochore at 735.272 kg/m^3

Temp. K	Pressure MPa	Z	Isotherm Derivative MPa•m^3/kg	Isochore Derivative MPa/K	Isochore Curvature MPa/K^2
134.860	.0000	.00000	2.23494	2.11009	-.0082374
136.000	2.4002	.16780	2.24373	2.10083	-.0080029
137.000	4.4971	.31209	2.25150	2.09293	-.0078062
138.000	6.5861	.45376	2.25932	2.08522	-.0076175
139.000	8.6676	.59286	2.26720	2.07769	-.0074365
140.000	10.7416	.72948	2.27513	2.07034	-.0072627
141.000	12.8083	.86367	2.28310	2.06316	-.0070958
142.000	14.8679	.99549	2.29112	2.05615	-.0069354
143.000	16.9207	1.12500	2.29918	2.04929	-.0067813
144.000	18.9666	1.25228	2.30727	2.04258	-.0066332
145.000	21.0059	1.37736	2.31540	2.03602	-.0064907
146.000	23.0387	1.50030	2.32356	2.02960	-.0063535
147.000	25.0651	1.62116	2.33176	2.02331	-.0062216
148.000	27.0853	1.73999	2.33998	2.01716	-.0060945
149.000	29.0995	1.85683	2.34823	2.01112	-.0059720
150.000	31.1076	1.97174	2.35651	2.00521	-.0058540
151.000	33.1099	2.08475	2.36481	1.99941	-.0057403
152.000	35.1065	2.19592	2.37313	1.99373	-.0056306
153.000	37.0974	2.30529	2.38147	1.98815	-.0055248
154.000	39.0828	2.41290	2.38983	1.98268	-.0054227
155.000	41.0628	2.51878	2.39821	1.97730	-.0053241
156.000	43.0375	2.62298	2.40660	1.97203	-.0052289
157.000	45.0069	2.72554	2.41501	1.96685	-.0051370
158.000	46.9712	2.82649	2.42343	1.96175	-.0050481
159.000	48.9304	2.92587	2.43186	1.95675	-.0049622
160.000	50.8847	3.02371	2.44030	1.95183	-.0048791
161.000	52.8341	3.12005	2.44876	1.94699	-.0047987
162.000	54.7787	3.21492	2.45722	1.94223	-.0047209
163.000	56.7186	3.30835	2.46569	1.93755	-.0046456
164.000	58.6538	3.40037	2.47416	1.93294	-.0045727
165.000	60.5845	3.49101	2.48265	1.92840	-.0045021
166.000	62.5107	3.58030	2.49113	1.92393	-.0044336
167.000	64.4324	3.66827	2.49962	1.91953	-.0043673
168.000	66.3498	3.75494	2.50812	1.91520	-.0043030
169.000	68.2628	3.84035	2.51661	1.91093	-.0042406
170.000	70.1716	3.92451	2.52511	1.90672	-.0041801

Table 18. Calculated P(ρ) isotherms of normal butane.

Normal Butane Isotherm at 140 K

Density kg/m^3	Pressure MPa	Z	Isotherm Derivative MPa•m^3/kg	Isochore Derivative MPa/K	Isochore Curvature MPa/K^2
.00	.0000	.99999	.02003	.00000	-.0000000
730.42	.0000	.00000	2.15683	2.03252	-.0075018
730.62	.4335	.02962	2.16164	2.03406	-.0074912
731.25	1.7892	.12217	2.17666	2.03886	-.0074586
731.88	3.1543	.21521	2.19176	2.04369	-.0074266
732.50	4.5290	.30874	2.20693	2.04854	-.0073952
733.12	5.9131	.40274	2.22217	2.05341	-.0073643
733.75	7.3067	.49724	2.23749	2.05831	-.0073341
734.38	8.7099	.59223	2.25289	2.06323	-.0073044
735.00	10.1228	.68771	2.26836	2.06818	-.0072752
735.63	11.5453	.78369	2.28391	2.07315	-.0072466
736.25	12.9777	.88017	2.29954	2.07814	-.0072185
736.87	14.4198	.97715	2.31524	2.08316	-.0071910
737.50	15.8718	1.07463	2.33102	2.08820	-.0071641
738.12	17.3337	1.17261	2.34688	2.09327	-.0071376
738.75	18.8053	1.27109	2.36282	2.09836	-.0071117
739.38	20.2871	1.37009	2.37883	2.10347	-.0070864
740.00	21.7789	1.46960	2.39493	2.10860	-.0070615
740.63	23.2808	1.56961	2.41110	2.11376	-.0070372
741.25	24.7928	1.67015	2.42736	2.11894	-.0070134
741.87	26.3150	1.77119	2.44369	2.12414	-.0069901
742.50	27.8474	1.87276	2.46011	2.12937	-.0069673
743.13	29.3901	1.97485	2.47660	2.13461	-.0069450
743.75	30.9432	2.07746	2.49318	2.13988	-.0069232

Normal Butane Isotherm at 150 K

.00	.0000	.99997	.02146	.00000	-.0000000
721.01	.0000	.00000	2.01286	1.89224	-.0062911
721.25	.4770	.03082	2.01827	1.89403	-.0062820
722.50	3.0178	.19466	2.04699	1.90352	-.0062354
723.75	5.5946	.36026	2.07598	1.91309	-.0061905
725.00	8.2078	.52762	2.10524	1.92275	-.0061474
726.25	10.8578	.69677	2.13479	1.93249	-.0061059
727.50	13.5449	.86771	2.16461	1.94232	-.0060661
728.75	16.2695	1.04046	2.19472	1.95222	-.0060279
730.00	19.0319	1.21503	2.22511	1.96221	-.0059913
731.25	21.8324	1.39144	2.25580	1.97228	-.0059563
732.50	24.6716	1.56971	2.28677	1.98242	-.0059228
733.75	27.5495	1.74983	2.31803	1.99265	-.0058909
735.00	30.4667	1.93183	2.34959	2.00296	-.0058605
736.25	33.4236	2.11572	2.38145	2.01334	-.0058315
737.50	36.4205	2.30152	2.41361	2.02379	-.0058041
738.75	39.4577	2.48923	2.44607	2.03433	-.0057781
740.00	42.5357	2.67888	2.47885	2.04494	-.0057535
741.25	45.6549	2.87047	2.51193	2.05562	-.0057304
742.50	48.8157	3.06403	2.54533	2.06638	-.0057086
743.75	52.0184	3.25957	2.57904	2.07721	-.0056883
745.00	55.2634	3.45710	2.61308	2.08811	-.0056692
746.25	58.5512	3.65664	2.64744	2.09908	-.0056516
747.50	61.8822	3.85820	2.68212	2.11012	-.0056352
748.75	65.2567	4.06180	2.71714	2.12123	-.0056202
750.00	68.6751	4.26745	2.75249	2.13241	-.0056064

Table 18. (Continued).

Normal Butane Isotherm at 160 K

Density kg/m^3	Pressure MPa	Z	Isotherm Derivative MPa•m^3/kg	Isochore Derivative MPa/K	Isochore Curvature MPa/K^2
.00	.0000	.99990	.02288	.00000	-.0000000
711.62	.0000	.00000	1.87808	1.76421	-.0053112
712.50	1.6660	.10216	1.89736	1.77075	-.0052872
713.75	4.0549	.24822	1.92488	1.78008	-.0052543
715.00	6.4783	.39587	1.95266	1.78948	-.0052228
716.25	8.9366	.54514	1.98069	1.79895	-.0051925
717.50	11.4301	.69603	2.00897	1.80850	-.0051635
718.75	13.9592	.84856	2.03752	1.81812	-.0051358
720.00	16.5240	1.00273	2.06633	1.82781	-.0051093
721.25	19.1251	1.15856	2.09540	1.83757	-.0050841
722.50	21.7626	1.31606	2.12474	1.84741	-.0050600
723.75	24.4370	1.47524	2.15434	1.85731	-.0050371
725.00	27.1486	1.63611	2.18422	1.86728	-.0050154
726.25	29.8977	1.79868	2.21437	1.87733	-.0049948
727.50	32.6847	1.96297	2.24479	1.88744	-.0049753
728.75	35.5098	2.12898	2.27550	1.89762	-.0049570
730.00	38.3735	2.29673	2.30648	1.90787	-.0049398
731.25	41.2761	2.46624	2.33774	1.91818	-.0049237
732.50	44.2181	2.63751	2.36930	1.92857	-.0049086
733.75	47.1995	2.81055	2.40113	1.93901	-.0048947
735.00	50.2210	2.98538	2.43326	1.94953	-.0048817
736.25	53.2828	3.16201	2.46568	1.96011	-.0048699
737.50	56.3854	3.34046	2.49840	1.97075	-.0048590
738.75	59.5289	3.52072	2.53142	1.98146	-.0048492
740.00	62.7140	3.70283	2.56474	1.99223	-.0048404
741.25	65.9409	3.88679	2.59836	2.00306	-.0048325
742.50	69.2100	4.07262	2.63230	2.01395	-.0048257

Normal Butane Isotherm at 180 K

.01	.0003	.99937	.02572	.00000	-.0000000
692.81	.0003	.00002	1.63122	1.53821	-.0038429
693.75	1.5495	.08674	1.64998	1.54483	-.0038301
695.00	3.6276	.20271	1.67501	1.55364	-.0038139
696.25	5.7371	.32002	1.70026	1.56250	-.0037986
697.50	7.8783	.43867	1.72574	1.57143	-.0037840
698.75	10.0515	.55867	1.75144	1.58042	-.0037701
700.00	12.2570	.68004	1.77737	1.58946	-.0037570
701.25	14.4950	.80278	1.80353	1.59856	-.0037447
702.50	16.7659	.92689	1.82992	1.60772	-.0037331
703.75	19.0699	1.05240	1.85654	1.61694	-.0037222
705.00	21.4074	1.17930	1.88340	1.62621	-.0037120
706.25	23.7785	1.30760	1.91049	1.63555	-.0037025
707.50	26.1837	1.43732	1.93782	1.64493	-.0036937
708.75	28.6232	1.56846	1.96538	1.65438	-.0036856
710.00	31.0972	1.70103	1.99319	1.66388	-.0036781
711.25	33.6062	1.83504	2.02124	1.67344	-.0036714
712.50	36.1504	1.97051	2.04954	1.68305	-.0036653
713.75	38.7302	2.10743	2.07808	1.69272	-.0036598
715.00	41.3457	2.24581	2.10686	1.70244	-.0036550
716.25	43.9974	2.38568	2.13590	1.71222	-.0036508
717.50	46.6856	2.52703	2.16519	1.72206	-.0036473
718.75	49.4105	2.66987	2.19473	1.73195	-.0036444
720.00	52.1725	2.81422	2.22453	1.74189	-.0036421
721.25	54.9720	2.96009	2.25459	1.75188	-.0036404
722.50	57.8091	3.10747	2.28491	1.76194	-.0036394
723.75	60.6843	3.25640	2.31548	1.77204	-.0036389
725.00	63.5979	3.40686	2.34633	1.78220	-.0036391
726.25	66.5503	3.55887	2.37743	1.79241	-.0036398
727.50	69.5416	3.71245	2.40881	1.80267	-.0036411

Table 18. (Continued).

Normal Butane Isotherm at 200 K

Density kg/m^3	Pressure MPa	Z	Isotherm Derivative MPa•m^3/kg	Isochore Derivative MPa/K	Isochore Curvature MPa/K^2
.07	.0019	.99751	.02847	.00001	-.0000000
673.85	.0019	.00010	1.40894	1.34406	-.0028162
675.00	1.6332	.08457	1.42965	1.35158	-.0028097
676.25	3.4345	.17752	1.45235	1.35981	-.0028031
677.50	5.2642	.27159	1.47527	1.36808	-.0027970
678.75	7.1227	.36680	1.49838	1.37641	-.0027914
680.00	9.0102	.46315	1.52170	1.38478	-.0027863
681.25	10.9271	.56065	1.54522	1.39320	-.0027816
682.50	12.8734	.65930	1.56895	1.40167	-.0027773
683.75	14.8495	.75911	1.59289	1.41019	-.0027735
685.00	16.8557	.86010	1.61704	1.41875	-.0027702
686.25	18.8922	.96226	1.64140	1.42736	-.0027672
687.50	20.9593	1.06560	1.66597	1.43603	-.0027647
688.75	23.0572	1.17014	1.69076	1.44474	-.0027627
690.00	25.1863	1.27587	1.71576	1.45349	-.0027610
691.25	27.3467	1.38281	1.74097	1.46230	-.0027598
692.50	29.5388	1.49096	1.76640	1.47115	-.0027589
693.75	31.7628	1.60032	1.79205	1.48005	-.0027585
695.00	34.0190	1.71092	1.81792	1.48900	-.0027585
696.25	36.3077	1.82274	1.84401	1.49800	-.0027589
697.50	38.6292	1.93581	1.87033	1.50704	-.0027597
698.75	40.9836	2.05012	1.89686	1.51613	-.0027608
700.00	43.3714	2.16569	1.92363	1.52527	-.0027624
701.25	45.7928	2.28253	1.95062	1.53445	-.0027643
702.50	48.2481	2.40063	1.97783	1.54369	-.0027667
703.75	50.7375	2.52001	2.00528	1.55297	-.0027694
705.00	53.2614	2.64067	2.03296	1.56229	-.0027725
706.25	55.8200	2.76263	2.06087	1.57167	-.0027759
707.50	58.4136	2.88589	2.08902	1.58108	-.0027798
708.75	61.0426	3.01045	2.11740	1.59055	-.0027840
710.00	63.7072	3.13633	2.14602	1.60006	-.0027886
711.25	66.4078	3.26353	2.17488	1.60962	-.0027936
712.50	69.1445	3.39207	2.20398	1.61923	-.0027989
713.75	71.9178	3.52194	2.23332	1.62888	-.0028046

Table 18. (Continued).

Normal Butane Isotherm at 220 K

Density kg/m^3	Pressure MPa	Z	Isotherm Derivative MPa·m^3/kg	Isochore Derivative MPa/K	Isochore Curvature MPa/K^2
.25	.0078	.99302	.03105	.00004	-.0000000
654.60	.0078	.00038	1.20671	1.17455	-.0020734
655.00	.4948	.02400	1.21322	1.17698	-.0020729
656.25	2.0240	.09800	1.23355	1.18457	-.0020717
657.50	3.5788	.17296	1.25406	1.19220	-.0020708
658.75	5.1593	.24887	1.27477	1.19987	-.0020702
660.00	6.7658	.32574	1.29566	1.20758	-.0020699
661.25	8.3985	.40359	1.31673	1.21533	-.0020699
662.50	10.0577	.48240	1.33800	1.22312	-.0020701
663.75	11.7436	.56221	1.35946	1.23095	-.0020707
665.00	13.4564	.64299	1.38111	1.23883	-.0020715
666.25	15.1965	.72478	1.40296	1.24674	-.0020726
667.50	16.9639	.80756	1.42499	1.25470	-.0020739
668.75	18.7590	.89134	1.44723	1.26270	-.0020755
670.00	20.5821	.97614	1.46965	1.27074	-.0020774
671.25	22.4333	1.06196	1.49228	1.27882	-.0020795
672.50	24.3129	1.14880	1.51510	1.28694	-.0020818
673.75	26.2211	1.23666	1.53812	1.29511	-.0020845
675.00	28.1583	1.32556	1.56134	1.30331	-.0020873
676.25	30.1246	1.41551	1.58477	1.31156	-.0020905
677.50	32.1203	1.50650	1.60839	1.31985	-.0020938
678.75	34.1456	1.59854	1.63222	1.32818	-.0020975
680.00	36.2009	1.69165	1.65625	1.33655	-.0021013
681.25	38.2863	1.78581	1.68049	1.34497	-.0021054
682.50	40.4022	1.88105	1.70494	1.35342	-.0021098
683.75	42.5488	1.97737	1.72959	1.36192	-.0021144
685.00	44.7263	2.07478	1.75445	1.37046	-.0021192
686.25	46.9350	2.17327	1.77952	1.37904	-.0021243
687.50	49.1752	2.27286	1.80481	1.38766	-.0021296
688.75	51.4471	2.37355	1.83030	1.39633	-.0021351
690.00	53.7510	2.47535	1.85601	1.40503	-.0021409
691.25	56.0872	2.57827	1.88194	1.41378	-.0021469
692.50	58.4560	2.68230	1.90808	1.42257	-.0021531
693.75	60.8575	2.78747	1.93444	1.43140	-.0021596
695.00	63.2921	2.89377	1.96102	1.44027	-.0021663
696.25	65.7601	3.00121	1.98781	1.44918	-.0021733
697.50	68.2618	3.10980	2.01483	1.45814	-.0021805
698.75	70.7973	3.21954	2.04207	1.46714	-.0021879

Table 18. (Continued).

Normal Butane Isotherm at 240 K

Density kg/m^3	Pressure MPa	Z	Isotherm Derivative MPa•m^3/kg	Isochore Derivative MPa/K	Isochore Curvature MPa/K^2
.71	.0241	.98456	.03332	.00010	-.0000000
634.87	.0241	.00110	1.02168	1.02453	-.0015203
635.00	.1576	.00723	1.02356	1.02526	-.0015205
637.50	2.7618	.12619	1.05990	1.03922	-.0015250
640.00	5.4577	.24839	1.09693	1.05332	-.0015302
642.50	8.2471	.37388	1.13467	1.06757	-.0015361
645.00	11.1317	.50270	1.17311	1.08196	-.0015427
647.50	14.1132	.63489	1.21226	1.09649	-.0015499
650.00	17.1936	.77048	1.25214	1.11117	-.0015578
652.50	20.3745	.90953	1.29274	1.12600	-.0015663
655.00	23.6578	1.05207	1.33409	1.14097	-.0015754
657.50	27.0455	1.19815	1.37617	1.15609	-.0015851
660.00	30.5394	1.34780	1.41901	1.17135	-.0015954
662.50	34.1412	1.50108	1.46260	1.18677	-.0016063
665.00	37.8530	1.65802	1.50696	1.20233	-.0016178
667.50	41.6767	1.81866	1.55210	1.21805	-.0016299
670.00	45.6142	1.98306	1.59802	1.23391	-.0016426
672.50	49.6674	2.15124	1.64472	1.24993	-.0016558
675.00	53.8385	2.32327	1.69223	1.26609	-.0016697
677.50	58.1292	2.49917	1.74054	1.28241	-.0016842
680.00	62.5418	2.67900	1.78967	1.29887	-.0016992
682.50	67.0783	2.86279	1.83962	1.31549	-.0017149
685.00	71.7406	3.05060	1.89040	1.33226	-.0017312

Normal Butane Isotherm at 260 K

1.69	.0610	.97089	.03511	.00025	-.0000001
614.46	.0610	.00267	.85208	.89018	-.0010979
615.00	.5249	.02295	.85896	.89293	-.0010998
617.50	2.7122	.11810	.89105	.90569	-.0011084
620.00	4.9806	.21599	.92379	.91858	-.0011174
622.50	7.3317	.31668	.95717	.93159	-.0011268
625.00	9.7671	.42018	.99122	.94473	-.0011366
627.50	12.2883	.52654	1.02592	.95799	-.0011467
630.00	14.8972	.63579	1.06130	.97139	-.0011572
632.50	17.5954	.74798	1.09736	.98491	-.0011681
635.00	20.3846	.86313	1.13410	.99857	-.0011793
637.50	23.2665	.98129	1.17153	1.01236	-.0011909
640.00	26.2429	1.10250	1.20967	1.02628	-.0012028
642.50	29.3154	1.22679	1.24851	1.04033	-.0012150
645.00	32.4860	1.35421	1.28806	1.05452	-.0012277
647.50	35.7563	1.48478	1.32833	1.06885	-.0012406
650.00	39.1283	1.61855	1.36933	1.08331	-.0012539
652.50	42.6036	1.75555	1.41106	1.09790	-.0012676
655.00	46.1841	1.89583	1.45354	1.11263	-.0012817
657.50	49.8719	2.03943	1.49676	1.12751	-.0012961
660.00	53.6686	2.18637	1.54074	1.14251	-.0013109
662.50	57.5762	2.33671	1.58549	1.15766	-.0013261
665.00	61.5967	2.49049	1.63100	1.17295	-.0013416
667.50	65.7319	2.64773	1.67729	1.18838	-.0013575
670.00	69.9838	2.80848	1.72437	1.20395	-.0013739

Table 18. (Continued).

Normal Butane Isotherm at 280 K

Density kg/m^3	Pressure MPa	Z	Isotherm Derivative MPa•m^3/kg	Isochore Derivative MPa/K	Isochore Curvature MPa/K^2
2.50	.0965	.96392	.03728	.00037	-.0000002
3.49	.1330	.95069	.03620	.00053	-.0000004
593.11	.1330	.00560	.69689	.76860	-.0007679
595.00	1.4717	.06175	.71778	.77732	-.0007762
597.50	3.3011	.13794	.74589	.78894	-.0007873
600.00	5.2016	.21645	.77460	.80066	-.0007986
602.50	7.1746	.29731	.80390	.81250	-.0008101
605.00	9.2217	.38055	.83382	.82446	-.0008218
607.50	11.3442	.46622	.86435	.83653	-.0008336
610.00	13.5440	.55434	.89551	.84872	-.0008456
612.50	15.8223	.64495	.92730	.86102	-.0008577
615.00	18.1810	.73808	.95972	.87344	-.0008701
617.50	20.6215	.83377	.99279	.88598	-.0008826
620.00	23.1455	.93205	1.02651	.89864	-.0008953
622.50	25.7546	1.03295	1.06089	.91143	-.0009082
625.00	28.4505	1.13651	1.09593	.92433	-.0009212
627.50	31.2348	1.24276	1.13164	.93736	-.0009345
630.00	34.1092	1.35175	1.16803	.95051	-.0009480
632.50	37.0755	1.46349	1.20511	.96378	-.0009616
635.00	40.1354	1.57804	1.24288	.97718	-.0009755
637.50	43.2905	1.69542	1.28135	.99071	-.0009896
640.00	46.5427	1.81566	1.32052	1.00436	-.0010039
642.50	49.8937	1.93881	1.36041	1.01815	-.0010185
645.00	53.3453	2.06491	1.40101	1.03206	-.0010332
647.50	56.8994	2.19397	1.44234	1.04610	-.0010482
650.00	60.5577	2.32605	1.48441	1.06027	-.0010635
652.50	64.3220	2.46118	1.52721	1.07457	-.0010790
655.00	68.1943	2.59938	1.57076	1.08900	-.0010948

Table 18. (Continued).

Normal Butane Isotherm at 298.150 K

Density kg/m3	Pressure MPa	Z	Isotherm Derivative MPa·m3/kg	Isochore Derivative MPa/K	Isochore Curvature MPa/K2
2.50	.1032	.96802	.04006	.00037	-.0000001
5.00	.2003	.93919	.03757	.00076	-.0000007
6.18	.2438	.92534	.03634	.00096	-.0000012
572.65	.2438	.00998	.56807	.66742	-.0005261
575.00	1.6070	.06553	.59049	.67726	-.0005378
577.50	3.1136	.12641	.61484	.68781	-.0005502
580.00	4.6817	.18926	.63973	.69847	-.0005627
582.50	6.3127	.25410	.66517	.70923	-.0005752
585.00	8.0080	.32096	.69117	.72009	-.0005877
587.50	9.7690	.38988	.71774	.73105	-.0006002
590.00	11.5972	.46088	.74489	.74213	-.0006128
592.50	13.4939	.53400	.77261	.75330	-.0006255
595.00	15.4608	.60926	.80093	.76459	-.0006382
597.50	17.4991	.68670	.82984	.77599	-.0006510
600.00	19.6105	.76634	.85935	.78749	-.0006638
602.50	21.7964	.84823	.88948	.79911	-.0006768
605.00	24.0584	.93239	.92022	.81084	-.0006898
607.50	26.3980	1.01885	.95158	.82268	-.0007029
610.00	28.8168	1.10765	.98358	.83463	-.0007160
612.50	31.3164	1.19882	1.01621	.84670	-.0007293
615.00	33.8984	1.29238	1.04949	.85889	-.0007428
617.50	36.5644	1.38838	1.08341	.87119	-.0007563
620.00	39.3160	1.48684	1.11800	.88361	-.0007699
622.50	42.1549	1.58780	1.15325	.89615	-.0007837
625.00	45.0828	1.69129	1.18917	.90881	-.0007976
627.50	48.1013	1.79734	1.22576	.92158	-.0008117
630.00	51.2122	1.90598	1.26304	.93448	-.0008259
632.50	54.4171	2.01726	1.30102	.94750	-.0008402
635.00	57.7178	2.13119	1.33969	.96064	-.0008547
637.50	61.1161	2.24782	1.37906	.97391	-.0008694
640.00	64.6137	2.36718	1.41915	.98729	-.0008843
642.50	68.2125	2.48930	1.45995	1.00081	-.0008993
645.00	71.9141	2.61421	1.50148	1.01444	-.0009145

Table 18. (Continued).

Normal Butane Isotherm at 300 K

Density kg/m^3	Pressure MPa	Z	Isotherm Derivative MPa•m^3/kg	Isochore Derivative MPa/K	Isochore Curvature MPa/K^2
2.50	.1039	.96839	.04034	.00037	-.0000001
5.00	.2017	.93998	.03788	.00076	-.0000006
6.52	.2582	.92233	.03630	.00102	-.0000014
570.49	.2582	.01055	.55557	.65753	-.0005039
572.50	1.3934	.05671	.57438	.66585	-.0005140
575.00	2.8591	.11587	.59826	.67628	-.0005265
577.50	4.3851	.17694	.62268	.68681	-.0005391
580.00	5.9729	.23997	.64764	.69744	-.0005516
582.50	7.6238	.30498	.67316	.70817	-.0005642
585.00	9.3392	.37201	.69924	.71901	-.0005768
587.50	11.1205	.44108	.72589	.72995	-.0005894
590.00	12.9691	.51222	.75311	.74100	-.0006021
592.50	14.8865	.58547	.78092	.75216	-.0006148
595.00	16.8742	.66085	.80931	.76342	-.0006276
597.50	18.9336	.73840	.83830	.77479	-.0006404
600.00	21.0662	.81815	.86790	.78627	-.0006534
602.50	23.2736	.90013	.89811	.79787	-.0006663
605.00	25.5572	.98437	.92893	.80957	-.0006794
607.50	27.9187	1.07090	.96038	.82139	-.0006925
610.00	30.3597	1.15976	.99246	.83332	-.0007058
612.50	32.8816	1.25097	1.02517	.84536	-.0007191
615.00	35.4861	1.34457	1.05854	.85752	-.0007325
617.50	38.1748	1.44059	1.09255	.86980	-.0007461
620.00	40.9494	1.53906	1.12722	.88220	-.0007598
622.50	43.8115	1.64002	1.16256	.89471	-.0007736
625.00	46.7627	1.74349	1.19857	.90734	-.0007875
627.50	49.8048	1.84952	1.23525	.92009	-.0008016
630.00	52.9395	1.95812	1.27262	.93296	-.0008158
632.50	56.1685	2.06935	1.31069	.94595	-.0008302
635.00	59.4936	2.18322	1.34945	.95907	-.0008447
637.50	62.9164	2.29977	1.38891	.97231	-.0008594
640.00	66.4387	2.41903	1.42909	.98567	-.0008743
642.50	70.0624	2.54104	1.46998	.99915	-.0008893

Table 18. (Continued).

Normal Butane Isotherm at 320 K

Density kg/m^3	Pressure MPa	Z	Isotherm Derivative MPa•m^3/kg	Isochore Derivative MPa/K	Isochore Curvature MPa/K^2
2.50	.1112	.97194	.04336	.00037	-.0000001
5.00	.2168	.94743	.04112	.00075	-.0000004
7.50	.3168	.92270	.03881	.00117	-.0000011
10.00	.4108	.89751	.03643	.00162	-.0000025
11.30	.4575	.88418	.03516	.00187	-.0000036
546.16	.4575	.01830	.42794	.55518	-.0002873
547.50	1.0367	.04136	.43823	.56008	-.0002946
550.00	2.1566	.08566	.45781	.56931	-.0003082
552.50	3.3261	.13152	.47788	.57863	-.0003215
555.00	4.5464	.17896	.49843	.58804	-.0003348
557.50	5.8187	.22801	.51946	.59754	-.0003479
560.00	7.1442	.27870	.54100	.60714	-.0003609
562.50	8.5241	.33105	.56304	.61683	-.0003739
565.00	9.9598	.38510	.58560	.62661	-.0003867
567.50	11.4525	.44087	.60867	.63649	-.0003995
570.00	13.0036	.49838	.63227	.64647	-.0004123
572.50	14.6143	.55767	.65641	.65654	-.0004250
575.00	16.2861	.61876	.68108	.66672	-.0004377
577.50	18.0202	.68168	.70631	.67700	-.0004504
580.00	19.8181	.74646	.73209	.68737	-.0004631
582.50	21.6811	.81312	.75843	.69785	-.0004757
585.00	23.6107	.88171	.78534	.70844	-.0004884
587.50	25.6083	.95224	.81283	.71912	-.0005011
590.00	27.6753	1.02474	.84090	.72992	-.0005139
592.50	29.8133	1.09924	.86956	.74081	-.0005266
595.00	32.0236	1.17578	.89882	.75182	-.0005394
597.50	34.3079	1.25438	.92868	.76293	-.0005523
600.00	36.6675	1.33506	.95915	.77416	-.0005652
602.50	39.1042	1.41787	.99025	.78549	-.0005781
605.00	41.6193	1.50283	1.02196	.79693	-.0005911
607.50	44.2145	1.58997	1.05431	.80848	-.0006042
610.00	46.8914	1.67932	1.08729	.82015	-.0006174
612.50	49.6515	1.77092	1.12092	.83193	-.0006307
615.00	52.4965	1.86478	1.15521	.84382	-.0006441
617.50	55.4281	1.96094	1.19014	.85582	-.0006575
620.00	58.4478	2.05944	1.22575	.86794	-.0006711
622.50	61.5574	2.16029	1.26202	.88018	-.0006847
625.00	64.7585	2.26354	1.29898	.89253	-.0006985
627.50	68.0528	2.36921	1.33661	.90500	-.0007124
630.00	71.4421	2.47734	1.37494	.91759	-.0007265

Table 18. (Continued).

Normal Butane Isotherm at 340 K

Density kg/m^3	Pressure MPa	Z	Isotherm Derivative MPa•m^3/kg	Isochore Derivative MPa/K	Isochore Curvature MPa/K^2
5.00	.2318	.95339	.04429	.00075	-.0000002
10.00	.4428	.91037	.04005	.00158	-.0000014
15.00	.6322	.86662	.03572	.00252	-.0000044
18.56	.7538	.83513	.03260	.00328	-.0000088
519.47	.7538	.02984	.31403	.46003	-.0001035
520.00	.9207	.03641	.31724	.46172	-.0001066
525.00	2.5845	.10122	.34853	.47787	-.0001355
530.00	4.4088	.17104	.38148	.49434	-.0001632
535.00	6.4022	.24605	.41614	.51114	-.0001898
540.00	8.5732	.32643	.45257	.52828	-.0002157
545.00	10.9309	.41238	.49082	.54577	-.0002409
550.00	13.4846	.50410	.53096	.56362	-.0002657
555.00	16.2438	.60178	.57304	.58184	-.0002902
560.00	19.2183	.70562	.61712	.60043	-.0003145
565.00	22.4184	.81583	.66325	.61940	-.0003385
570.00	25.8543	.93261	.71148	.63877	-.0003625
575.00	29.5368	1.05618	.76189	.65852	-.0003864
580.00	33.4769	1.18675	.81451	.67868	-.0004104
585.00	37.6858	1.32454	.86942	.69925	-.0004345
590.00	42.1750	1.46976	.92666	.72023	-.0004587
595.00	46.9563	1.62263	.98628	.74163	-.0004830
600.00	52.0418	1.78338	1.04835	.76346	-.0005076
605.00	57.4439	1.95223	1.11291	.78573	-.0005325
610.00	63.1752	2.12941	1.18002	.80843	-.0005577
615.00	69.2485	2.31514	1.24974	.83158	-.0005832

Normal Butane Isotherm at 360 K

5.00	.2467	.95829	.04741	.00074	-.0000002
10.00	.4741	.92065	.04352	.00156	-.0000009
15.00	.6819	.88284	.03962	.00245	-.0000027
20.00	.8703	.84502	.03573	.00345	-.0000059
25.00	1.0393	.80729	.03187	.00456	-.0000115
29.39	1.1718	.77422	.02847	.00565	-.0000200
489.36	1.1718	.04650	.21405	.37071	.0000609
490.00	1.3100	.05192	.21699	.37246	.0000567
495.00	2.4534	.09625	.24058	.38624	.0000250
500.00	3.7181	.14440	.26554	.40030	-.0000045
505.00	5.1111	.19654	.29192	.41466	-.0000321
510.00	6.6397	.25281	.31977	.42932	-.0000584
515.00	8.3114	.31339	.34915	.44429	-.0000836
520.00	10.1338	.37843	.38011	.45959	-.0001080
525.00	12.1152	.44812	.41270	.47521	-.0001317
530.00	14.2637	.52261	.44699	.49118	-.0001549
535.00	16.5880	.60209	.48302	.50748	-.0001777
540.00	19.0969	.68673	.52085	.52414	-.0002001
545.00	21.7996	.77673	.56054	.54116	-.0002224
550.00	24.7055	.87227	.60214	.55854	-.0002444
555.00	27.8243	.97353	.64571	.57630	-.0002664
560.00	31.1660	1.08072	.69130	.59443	-.0002884
565.00	34.7408	1.19402	.73898	.61294	-.0003103
570.00	38.5593	1.31363	.78878	.63184	-.0003323
575.00	42.6323	1.43976	.84078	.65114	-.0003544
580.00	46.9709	1.57261	.89502	.67083	-.0003766
585.00	51.5864	1.71237	.95157	.69094	-.0003990
590.00	56.4905	1.85927	1.01047	.71145	-.0004216
595.00	61.6952	2.01351	1.07179	.73238	-.0004444
600.00	67.2125	2.17529	1.13556	.75374	-.0004675

Table 18. (Continued).

Normal Butane Isotherm at 380 K

Density kg/m^3	Pressure MPa	Z	Isotherm Derivative MPa•m^3/kg	Isochore Derivative MPa/K	Isochore Curvature MPa/K^2
5.00	.2616	.96242	.05050	.00074	-.0000001
10.00	.5051	.92915	.04689	.00154	-.0000007
15.00	.7306	.89600	.04332	.00241	-.0000018
20.00	.9383	.86310	.03980	.00336	-.0000038
25.00	1.1286	.83052	.03634	.00439	-.0000068
30.00	1.3018	.79829	.03294	.00550	-.0000112
35.00	1.4581	.76639	.02959	.00672	-.0000177
40.00	1.5977	.73482	.02629	.00804	-.0000272
45.00	1.7210	.70357	.02303	.00948	-.0000422
45.78	1.7387	.69873	.02252	.00972	-.0000453
453.83	1.7387	.07048	.12849	.28570	.0002238
455.00	1.8910	.07646	.13216	.28832	.0002143
460.00	2.5923	.10367	.14849	.29965	.0001769
465.00	3.3777	.13363	.16588	.31122	.0001438
470.00	4.2529	.16647	.18437	.32305	.0001137
475.00	5.2234	.20230	.20403	.33514	.0000860
480.00	6.2952	.24127	.22488	.34751	.0000601
485.00	7.4743	.28351	.24699	.36017	.0000356
490.00	8.7673	.32916	.27041	.37312	.0000123
495.00	10.1806	.37836	.29517	.38637	-.0000102
500.00	11.7213	.43127	.32134	.39993	-.0000319
505.00	13.3964	.48802	.34896	.41380	-.0000532
510.00	15.2134	.54877	.37808	.42799	-.0000739
515.00	17.1798	.61369	.40876	.44251	-.0000943
520.00	19.3036	.68293	.44104	.45737	-.0001145
525.00	21.5930	.75664	.47499	.47256	-.0001344
530.00	24.0564	.83501	.51066	.48809	-.0001542
535.00	26.7025	.91820	.54809	.50398	-.0001739
540.00	29.5403	1.00637	.58735	.52022	-.0001935
545.00	32.5791	1.09972	.62849	.53682	-.0002132
550.00	35.8284	1.19840	.67156	.55378	-.0002328
555.00	39.2980	1.30261	.71662	.57112	-.0002526
560.00	42.9981	1.41253	.76373	.58883	-.0002724
565.00	46.9389	1.52835	.81295	.60692	-.0002923
570.00	51.1311	1.65025	.86432	.62541	-.0003124
575.00	55.5857	1.77842	.91790	.64428	-.0003327
580.00	60.3139	1.91306	.97375	.66355	-.0003532
585.00	65.3271	2.05436	1.03192	.68322	-.0003739
590.00	70.6371	2.20252	1.09248	.70330	-.0003948

Table 18. (Continued).

Normal Butane Isotherm at 400 K

Density kg/m^3	Pressure MPa	Z	Isotherm Derivative MPa·m^3/kg	Isochore Derivative MPa/K	Isochore Curvature MPa/K^2
5.00	.2764	.96595	.05356	.00074	-.0000001
10.00	.5357	.93632	.05020	.00153	-.0000005
15.00	.7784	.90698	.04689	.00238	-.0000013
20.00	1.0048	.87802	.04366	.00329	-.0000027
25.00	1.2152	.84948	.04050	.00427	-.0000046
30.00	1.4099	.82136	.03742	.00532	-.0000073
35.00	1.5894	.79366	.03440	.00644	-.0000108
40.00	1.7540	.76638	.03146	.00763	-.0000154
45.00	1.9041	.73951	.02859	.00890	-.0000212
50.00	2.0401	.71308	.02580	.01023	-.0000288
55.00	2.1623	.68710	.02311	.01165	-.0000385
60.00	2.2713	.66159	.02050	.01315	-.0000514
65.00	2.3675	.63655	.01798	.01474	-.0000691
70.00	2.4513	.61200	.01555	.01643	-.0000947
72.54	2.4892	.59973	.01435	.01734	-.0001128
408.02	2.4892	.10662	.05843	.20249	.0004306
410.00	2.6082	.11118	.06193	.20585	.0004060
415.00	2.9409	.12385	.07129	.21447	.0003528
420.00	3.3223	.13824	.08138	.22328	.0003089
425.00	3.7560	.15445	.09223	.23230	.0002716
430.00	4.2460	.17257	.10390	.24155	.0002389
435.00	4.7964	.19270	.11641	.25103	.0002097
440.00	5.4116	.21495	.12982	.26075	.0001832
445.00	6.0961	.23942	.14415	.27073	.0001587
450.00	6.8547	.26622	.15946	.28097	.0001358
455.00	7.6924	.29547	.17577	.29148	.0001141
460.00	8.6142	.32728	.19314	.30227	.0000935
465.00	9.6256	.36177	.21161	.31333	.0000736
470.00	10.7322	.39907	.23121	.32468	.0000544
475.00	11.9397	.43930	.25201	.33632	.0000357
480.00	13.2543	.48259	.27403	.34826	.0000175
485.00	14.6822	.52907	.29734	.36050	-.0000005
490.00	16.2299	.57887	.32197	.37304	-.0000181
495.00	17.9041	.63214	.34797	.38590	-.0000356
500.00	19.7120	.68900	.37540	.39907	-.0000529
505.00	21.6606	.74962	.40430	.41256	-.0000702
510.00	23.7575	.81413	.43473	.42638	-.0000873
515.00	26.0105	.88268	.46673	.44052	-.0001045
520.00	28.4276	.95543	.50037	.45501	-.0001216
525.00	31.0170	1.03253	.53568	.46983	-.0001388
530.00	33.7873	1.11414	.57274	.48499	-.0001560
535.00	36.7473	1.20042	.61158	.50051	-.0001733
540.00	39.9062	1.29154	.65227	.51638	-.0001907
545.00	43.2732	1.38766	.69486	.53261	-.0002082
550.00	46.8580	1.48896	.73940	.54920	-.0002258
555.00	50.6705	1.59560	.78595	.56616	-.0002436
560.00	54.7210	1.70776	.83457	.58350	-.0002616
565.00	59.0198	1.82562	.88532	.60121	-.0002798
570.00	63.5778	1.94936	.93824	.61931	-.0002982
575.00	68.4059	2.07916	.99339	.63779	-.0003168

Table 18. (Continued).

Normal Butane Isotherm at 410 K

Density kg/m^3	Pressure MPa	Z	Isotherm Derivative MPa•m^3/kg	Isochore Derivative MPa/K	Isochore Curvature MPa/K^2
5.00	.2837	.96753	.05508	.00074	-.0000001
10.00	.5510	.93950	.05183	.00152	-.0000004
15.00	.8022	.91183	.04864	.00237	-.0000012
20.00	1.0376	.88457	.04554	.00327	-.0000023
25.00	1.2577	.85776	.04251	.00423	-.0000039
30.00	1.4628	.83139	.03956	.00526	-.0000061
35.00	1.6534	.80544	.03667	.00634	-.0000089
40.00	1.8297	.77992	.03386	.00749	-.0000124
45.00	1.9921	.75481	.03113	.00871	-.0000168
50.00	2.1411	.73014	.02848	.00998	-.0000221
55.00	2.2771	.70592	.02592	.01132	-.0000286
60.00	2.4005	.68217	.02346	.01272	-.0000365
65.00	2.5119	.65890	.02110	.01418	-.0000461
70.00	2.6117	.63614	.01883	.01570	-.0000580
75.00	2.7004	.61391	.01668	.01729	-.0000730
80.00	2.7786	.59221	.01462	.01895	-.0000923
85.00	2.8468	.57105	.01267	.02068	-.0001183
90.00	2.9055	.55045	.01082	.02250	-.0001553
94.40	2.9496	.53278	.00927	.02419	-.0002043
376.69	2.9496	.13351	.03006	.15957	.0006105
380.00	3.0554	.13709	.03375	.16416	.0005486
385.00	3.2388	.14344	.03973	.17120	.0004756
390.00	3.4536	.15099	.04626	.17839	.0004186
395.00	3.7024	.15982	.05337	.18577	.0003724
400.00	3.9883	.17001	.06110	.19335	.0003335
405.00	4.3145	.18164	.06948	.20114	.0002999
410.00	4.6843	.19480	.07855	.20915	.0002703
415.00	5.1012	.20959	.08833	.21740	.0002436
420.00	5.5689	.22608	.09887	.22588	.0002193
425.00	6.0912	.24437	.11020	.23462	.0001968
430.00	6.6722	.26457	.12235	.24360	.0001757
435.00	7.3162	.28677	.13537	.25284	.0001557
440.00	8.0274	.31107	.14929	.26234	.0001367
445.00	8.8107	.33759	.16416	.27211	.0001183
450.00	9.6706	.36642	.18000	.28215	.0001006
455.00	10.6124	.39768	.19687	.29246	.0000834
460.00	11.6411	.43149	.21480	.30306	.0000666
465.00	12.7622	.46796	.23384	.31395	.0000500
470.00	13.9813	.50721	.25402	.32512	.0000337
475.00	15.3044	.54937	.27541	.33659	.0000176
480.00	16.7375	.59455	.29803	.34835	.0000017
485.00	18.2869	.64289	.32195	.36042	-.0000142
490.00	19.9592	.69452	.34719	.37280	-.0000300
495.00	21.7612	.74957	.37383	.38549	-.0000458
500.00	23.6999	.80819	.40189	.39850	-.0000615
505.00	25.7826	.87051	.43144	.41182	-.0000773
510.00	28.0168	.93667	.46252	.42547	-.0000931
515.00	30.4105	1.00682	.49519	.43946	-.0001090
520.00	32.9715	1.08112	.52950	.45377	-.0001249
525.00	35.7083	1.15971	.56550	.46843	-.0001410
530.00	38.6294	1.24274	.60325	.48343	-.0001571
535.00	41.7438	1.33038	.64279	.49878	-.0001734
540.00	45.0605	1.42279	.68419	.51448	-.0001899
545.00	48.5889	1.52012	.72750	.53053	-.0002065
550.00	52.3388	1.62255	.77278	.54696	-.0002232
555.00	56.3200	1.73024	.82007	.56374	-.0002402
560.00	60.5429	1.84337	.86944	.58090	-.0002574
565.00	65.0180	1.96211	.92094	.59844	-.0002748
570.00	69.7560	2.08663	.97463	.61635	-.0002924

Table 18. (Continued).

Normal Butane Isotherm at 420 K

Density kg/m^3	Pressure MPa	Z	Isotherm Derivative MPa•m^3/kg	Isochore Derivative MPa/K	Isochore Curvature MPa/K^2
10.00	.5662	.94246	.05346	.00152	-.0000004
20.00	1.0702	.89062	.04739	.00325	-.0000020
30.00	1.5151	.84060	.04164	.00520	-.0000052
40.00	1.9040	.79229	.03619	.00738	-.0000103
50.00	2.2399	.74564	.03104	.00978	-.0000178
60.00	2.5260	.70074	.02624	.01240	-.0000281
70.00	2.7661	.65772	.02183	.01521	-.0000418
80.00	2.9641	.61670	.01784	.01821	-.0000602
90.00	3.1243	.57780	.01427	.02137	-.0000849
100.00	3.2509	.54109	.01112	.02469	-.0001192
110.00	3.3481	.50661	.00839	.02816	-.0001701
120.00	3.4199	.47436	.00604	.03180	-.0002547
130.00	3.4701	.44429	.00405	.03566	-.0004309
133.47	3.4830	.43436	.00342	.03710	-.0005514
328.06	3.4830	.17672	.00760	.11119	.0011287
330.00	3.4985	.17646	.00840	.11304	.0010246
340.00	3.6053	.17650	.01315	.12277	.0007067
350.00	3.7658	.17909	.01918	.13303	.0005459
360.00	3.9940	.18466	.02671	.14398	.0004450
370.00	4.3058	.19370	.03595	.15571	.0003732
380.00	4.7195	.20672	.04712	.16829	.0003176
390.00	5.2554	.22429	.06045	.18174	.0002717
400.00	5.9365	.24703	.07618	.19612	.0002320
410.00	6.7880	.27557	.09457	.21146	.0001964
420.00	7.8377	.31061	.11588	.22778	.0001636
430.00	9.1162	.35287	.14039	.24513	.0001326
440.00	10.6571	.40314	.16839	.26353	.0001028
450.00	12.4967	.46223	.20019	.28301	.0000737
460.00	14.6746	.53098	.23612	.30362	.0000451
470.00	17.2339	.61032	.27651	.32537	.0000167
480.00	20.2209	.70118	.32172	.34830	-.0000116
490.00	23.6855	.80456	.37211	.37245	-.0000402
500.00	27.6816	.92150	.42807	.39784	-.0000690
510.00	32.2668	1.05307	.49000	.42452	-.0000983
520.00	37.5029	1.20042	.55832	.45251	-.0001280
530.00	43.4558	1.36472	.63343	.48185	-.0001583
540.00	50.1957	1.54720	.71579	.51258	-.0001892
550.00	57.7972	1.74911	.80582	.54473	-.0002210
560.00	66.3391	1.97176	.90396	.57835	-.0002536

Table 18. (Continued).

Normal Butane Isotherm at 425.160 K

Density kg/m^3	Pressure MPa	Z	Isotherm Derivative MPa•m^3/kg	Isochore Derivative MPa/K	Isochore Curvature MPa/K^2
10.00	.5741	.94390	.05429	.00152	-.0000004
20.00	1.0869	.89357	.04833	.00324	-.0000018
30.00	1.5419	.84507	.04271	.00517	-.0000048
40.00	1.9420	.79827	.03736	.00733	-.0000094
50.00	2.2902	.75312	.03233	.00970	-.0000161
60.00	2.5896	.70967	.02763	.01226	-.0000250
70.00	2.8440	.66804	.02331	.01501	-.0000365
80.00	3.0573	.62837	.01940	.01792	-.0000510
90.00	3.2335	.59074	.01591	.02098	-.0000691
100.00	3.3768	.55523	.01283	.02415	-.0000918
110.00	3.4914	.52189	.01015	.02743	-.0001201
120.00	3.5812	.49069	.00786	.03078	-.0001560
130.00	3.6498	.46163	.00593	.03419	-.0002022
140.00	3.7009	.43465	.00433	.03763	-.0002635
150.00	3.7375	.40969	.00303	.04108	-.0003476
160.00	3.7625	.38665	.00201	.04451	-.0004680
170.00	3.7786	.36547	.00124	.04791	-.0006511
180.00	3.7881	.34603	.00069	.05123	-.0009514
190.00	3.7930	.32825	.00033	.05445	-.0014992
200.00	3.7952	.31201	.00012	.05752	-.0026725
210.00	3.7959	.29721	.00003	.06036	-.0060057
220.00	3.7960	.28371	.00000	.06285	-.0251804
230.00	3.7960	.27137	.00000	.06455	.3759035
240.00	3.7960	.26007	.00001	.06684	.0113369
250.00	3.7964	.24969	.00008	.06985	.0044633
260.00	3.7979	.24018	.00025	.07348	.0025343
270.00	3.8021	.23154	.00062	.07770	.0016947
280.00	3.8112	.22381	.00127	.08253	.0012437
290.00	3.8287	.21708	.00230	.08798	.0009687
300.00	3.8590	.21151	.00385	.09408	.0007860
310.00	3.9079	.20728	.00605	.10086	.0006567
320.00	3.9827	.20464	.00905	.10835	.0005603
330.00	4.0921	.20389	.01301	.11657	.0004855
340.00	4.2466	.20537	.01811	.12556	.0004251
350.00	4.4586	.20946	.02453	.13534	.0003748
360.00	4.7422	.21660	.03248	.14595	.0003317
370.00	5.1138	.22726	.04215	.15742	.0002937
380.00	5.5918	.24196	.05378	.16977	.0002593
390.00	6.1966	.26125	.06758	.18303	.0002277
400.00	6.9514	.28575	.08380	.19723	.0001979
410.00	7.8816	.31608	.10269	.21240	.0001695
420.00	9.0151	.35293	.12452	.22857	.0001420
430.00	10.3827	.39702	.14957	.24576	.0001151
440.00	12.0182	.44911	.17812	.26402	.0000886
450.00	13.9579	.51001	.21050	.28336	.0000621
460.00	16.2419	.58056	.24701	.30382	.0000357
470.00	18.9130	.66166	.28800	.32543	.0000091
480.00	22.0179	.75423	.33382	.34823	-.0000177
490.00	25.6068	.85927	.38485	.37223	-.0000449
500.00	29.7335	.97779	.44146	.39748	-.0000725
510.00	34.4560	1.11087	.50407	.42400	-.0001007
520.00	39.8362	1.25963	.57307	.45184	-.0001294
530.00	45.9401	1.42523	.64889	.48103	-.0001588
540.00	52.8381	1.60888	.73197	.51161	-.0001890
550.00	60.6051	1.81182	.82274	.54360	-.0002199
560.00	69.3201	2.03535	.92165	.57704	-.0002518

Table 18. (Continued).

Normal Butane Isotherm at 430 K

Density kg/m^3	Pressure MPa	Z	Isotherm Derivative MPa•m^3/kg	Isochore Derivative MPa/K	Isochore Curvature MPa/K^2
10.00	.5814	.94521	.05507	.00152	-.0000003
20.00	1.1025	.89623	.04922	.00323	-.0000017
30.00	1.5668	.84910	.04369	.00515	-.0000044
40.00	1.9773	.80366	.03845	.00729	-.0000087
50.00	2.3369	.75984	.03351	.00962	-.0000147
60.00	2.6487	.71769	.02891	.01215	-.0000226
70.00	2.9163	.67730	.02467	.01484	-.0000325
80.00	3.1434	.63880	.02083	.01769	-.0000445
90.00	3.3342	.60229	.01740	.02067	-.0000589
100.00	3.4927	.56782	.01437	.02375	-.0000756
110.00	3.6228	.53544	.01173	.02691	-.0000948
120.00	3.7285	.50513	.00946	.03013	-.0001161
130.00	3.8132	.47687	.00754	.03338	-.0001392
140.00	3.8804	.45061	.00594	.03664	-.0001630
150.00	3.9331	.42628	.00463	.03988	-.0001854
160.00	3.9740	.40379	.00359	.04308	-.0002035
170.00	4.0056	.38307	.00278	.04623	-.0002132
180.00	4.0303	.36402	.00219	.04932	-.0002103
190.00	4.0500	.34654	.00178	.05238	-.0001916
200.00	4.0665	.33056	.00154	.05544	-.0001570
210.00	4.0813	.31596	.00144	.05852	-.0001087
220.00	4.0956	.30266	.00144	.06169	-.0000508
230.00	4.1103	.29053	.00150	.06499	.0000139
240.00	4.1257	.27947	.00160	.06847	.0000832
250.00	4.1426	.26939	.00180	.07216	.0001544
260.00	4.1623	.26027	.00217	.07615	.0002221
270.00	4.1868	.25210	.00277	.08050	.0002802
280.00	4.2189	.24496	.00369	.08531	.0003238
290.00	4.2621	.23893	.00503	.09064	.0003508
300.00	4.3212	.23417	.00690	.09658	.0003620
310.00	4.4022	.23087	.00943	.10317	.0003605
320.00	4.5126	.22926	.01279	.11047	.0003498
330.00	4.6612	.22964	.01712	.11850	.0003331
340.00	4.8588	.23233	.02260	.12732	.0003128
350.00	5.1177	.23771	.02942	.13694	.0002905
360.00	5.4523	.24622	.03778	.14739	.0002672
370.00	5.8790	.25832	.04788	.15871	.0002435
380.00	6.4163	.27451	.05994	.17092	.0002198
390.00	7.0850	.29534	.07419	.18405	.0001960
400.00	7.9082	.32142	.09087	.19812	.0001723
410.00	8.9115	.35336	.11024	.21317	.0001485
420.00	10.1229	.39184	.13257	.22921	.0001248
430.00	11.5735	.43757	.15812	.24629	.0001009
440.00	13.2970	.49131	.18719	.26442	.0000768
450.00	15.3301	.55384	.22010	.28364	.0000524
460.00	17.7128	.62601	.25716	.30398	.0000277
470.00	20.4882	.70869	.29871	.32546	.0000026
480.00	23.7031	.80282	.34511	.34813	-.0000229
490.00	27.4078	.90935	.39673	.37200	-.0000490
500.00	31.6564	1.02931	.45396	.39712	-.0000756
510.00	36.5070	1.16375	.51719	.42351	-.0001028
520.00	42.0216	1.31378	.58683	.45121	-.0001307
530.00	48.2664	1.48055	.66331	.48026	-.0001593
540.00	55.3121	1.66525	.74707	.51069	-.0001887
550.00	63.2335	1.86912	.83854	.54253	-.0002190

Table 18. (Continued).

Normal Butane Isotherm at 440 K

Density kg/m3	Pressure MPa	Z	Isotherm Derivative MPa•m3/kg	Isochore Derivative MPa/K	Isochore Curvature MPa/K2
20.00	1.1348	.90145	.05102	.00321	-.0000015
40.00	2.0498	.81418	.04067	.00721	-.0000075
60.00	2.7691	.73326	.03148	.01194	-.0000187
80.00	3.3183	.65901	.02369	.01730	-.0000351
100.00	3.7268	.59211	.01742	.02310	-.0000554
120.00	4.0248	.53288	.01262	.02919	-.0000769
140.00	4.2401	.48119	.00912	.03542	-.0000943
160.00	4.3970	.43662	.00674	.04168	-.0001009
180.00	4.5160	.39861	.00532	.04800	-.0000908
200.00	4.6154	.36665	.00475	.05449	-.0000628
220.00	4.7108	.34021	.00488	.06139	-.0000207
240.00	4.8132	.31863	.00542	.06895	.0000307
260.00	4.9315	.30135	.00656	.07748	.0000870
280.00	5.0836	.28846	.00891	.08736	.0001399
300.00	5.3009	.28073	.01321	.09907	.0001797
320.00	5.6315	.27960	.02043	.11308	.0002001
340.00	6.1453	.28717	.03175	.12981	.0002014
360.00	6.9380	.30620	.04857	.14963	.0001876
380.00	8.1355	.34015	.07250	.17281	.0001633
400.00	9.8973	.39312	.10532	.19963	.0001320
420.00	12.4208	.46986	.14901	.23031	.0000959
440.00	15.9447	.57575	.20575	.26508	.0000561
460.00	20.7537	.71681	.27794	.30418	.0000132
480.00	27.1831	.89976	.36825	.34785	-.0000326
500.00	35.6237	1.13198	.47958	.39633	-.0000813
520.00	46.5271	1.42158	.61506	.44990	-.0001331
540.00	60.4096	1.77738	.77805	.50881	-.0001882

Normal Butane Isotherm at 450 K

20.00	1.1668	.90631	.05281	.00320	-.0000014
40.00	2.1215	.82393	.04284	.00714	-.0000065
60.00	2.8876	.74765	.03398	.01177	-.0000158
80.00	3.4896	.67763	.02645	.01698	-.0000287
100.00	3.9553	.61445	.02036	.02261	-.0000435
120.00	4.3133	.55839	.01566	.02853	-.0000574
140.00	4.5901	.50934	.01222	.03463	-.0000670
160.00	4.8094	.46696	.00988	.04086	-.0000685
180.00	4.9921	.43084	.00855	.04727	-.0000599
200.00	5.1576	.40062	.00816	.05399	-.0000412
220.00	5.3238	.37593	.00857	.06122	-.0000145
240.00	5.5040	.35627	.00953	.06919	.0000180
260.00	5.7100	.34117	.01125	.07816	.0000539
280.00	5.9633	.33085	.01437	.08847	.0000892
300.00	6.2994	.32620	.01967	.10052	.0001188
320.00	6.7711	.32871	.02811	.11473	.0001382
340.00	7.4524	.34051	.04085	.13152	.0001454
360.00	8.4428	.36433	.05926	.15125	.0001406
380.00	9.8711	.40354	.08492	.17425	.0001256
400.00	11.8997	.46215	.11960	.20080	.0001026
420.00	14.7283	.54477	.16527	.23115	.0000734
440.00	18.5980	.65663	.22410	.26555	.0000393
460.00	23.7959	.80363	.29851	.30425	.0000010
480.00	30.6598	.99229	.39115	.34748	-.0000409
500.00	39.5829	1.22984	.50494	.39549	-.0000863
520.00	51.0194	1.52420	.64303	.44855	-.0001351
540.00	65.4883	1.88399	.80875	.50693	-.0001876

Table 18. (Continued).

Normal Butane Isotherm at 500 K

Density kg/m^3	Pressure MPa	Z	Isotherm Derivative MPa•m^3/kg	Isochore Derivative MPa/K	Isochore Curvature MPa/K^2
20.00	1.3253	.92648	.06157	.00315	-.0000008
40.00	2.4716	.86392	.05323	.00689	-.0000036
60.00	3.4603	.80634	.04580	.01120	-.0000082
80.00	4.3107	.75338	.03943	.01599	-.0000138
100.00	5.0452	.70539	.03422	.02118	-.0000194
120.00	5.6878	.66269	.03023	.02671	-.0000239
140.00	6.2624	.62541	.02743	.03258	-.0000264
160.00	6.7931	.59360	.02583	.03881	-.0000261
180.00	7.3040	.56734	.02548	.04549	-.0000230
200.00	7.8210	.54675	.02645	.05273	-.0000172
220.00	8.3704	.53195	.02869	.06069	-.0000091
240.00	8.9754	.52287	.03199	.06954	.0000007
260.00	9.6594	.51943	.03669	.07949	.0000115
280.00	10.4575	.52218	.04355	.09078	.0000224
300.00	11.4216	.53230	.05344	.10370	.0000323
320.00	12.6222	.55149	.06738	.11854	.0000397
340.00	14.1514	.58193	.08651	.13564	.0000435
360.00	16.1263	.62630	.11219	.15531	.0000428
380.00	18.6924	.68775	.14590	.17789	.0000369
400.00	22.0272	.76993	.18936	.20368	.0000256
420.00	26.3446	.87699	.24449	.23298	.0000092
440.00	31.8990	1.01362	.31344	.26606	-.0000121
460.00	38.9903	1.18509	.39861	.30320	-.0000380
480.00	47.9691	1.39724	.50265	.34467	-.0000683
500.00	59.2416	1.65656	.62849	.39072	-.0001027

Normal Butane Isotherm at 550 K

20.00	1.4817	.94166	.07009	.00311	-.0000005
40.00	2.8124	.89368	.06312	.00675	-.0000023
60.00	4.0117	.84983	.05693	.01088	-.0000050
80.00	5.0956	.80959	.05162	.01545	-.0000083
100.00	6.0837	.77327	.04738	.02043	-.0000115
120.00	6.9985	.74128	.04430	.02580	-.0000140
140.00	7.8641	.71397	.04247	.03157	-.0000155
160.00	8.7064	.69164	.04200	.03781	-.0000157
180.00	9.5541	.67465	.04303	.04458	-.0000146
200.00	10.4386	.66340	.04571	.05202	-.0000122
220.00	11.3935	.65826	.05005	.06024	-.0000088
240.00	12.4505	.65938	.05590	.06942	-.0000047
260.00	13.6422	.66692	.06367	.07973	-.0000002
280.00	15.0154	.68161	.07419	.09138	.0000042
300.00	16.6345	.70477	.08842	.10462	.0000079
320.00	18.5839	.73815	.10742	.11969	.0000103
340.00	20.9709	.78397	.13238	.13687	.0000105
360.00	23.9279	.84481	.16465	.15647	.0000081
380.00	27.6158	.92370	.20574	.17876	.0000025
400.00	32.2273	1.02405	.25731	.20406	-.0000067
420.00	37.9908	1.14971	.32128	.23263	-.0000197
440.00	45.1750	1.30498	.39975	.26478	-.0000364
460.00	54.0936	1.49467	.49513	.30077	-.0000571
480.00	65.1105	1.72412	.61006	.34088	-.0000815

Table 18. (Continued).

Normal Butane Isotherm at 600 K

Density kg/m^3	Pressure MPa	Z	Isotherm Derivative MPa•m^3/kg	Isochore Derivative MPa/K	Isochore Curvature MPa/K^2
20.00	1.6368	.95353	.07847	.00309	-.0000004
40.00	3.1474	.91677	.07272	.00665	-.0000016
60.00	4.5501	.88356	.06766	.01067	-.0000034
80.00	5.8591	.85332	.06340	.01511	-.0000056
100.00	7.0927	.82639	.06015	.01996	-.0000077
120.00	8.2731	.80326	.05810	.02522	-.0000095
140.00	9.4258	.78444	.05740	.03093	-.0000107
160.00	10.5795	.77040	.05824	.03715	-.0000112
180.00	11.7669	.76166	.06082	.04396	-.0000110
200.00	13.0252	.75880	.06535	.05146	-.0000102
220.00	14.3946	.76234	.07191	.05980	-.0000089
240.00	15.9143	.77259	.08039	.06911	-.0000072
260.00	17.6259	.78986	.09124	.07957	-.0000056
280.00	19.5858	.81499	.10538	.09136	-.0000041
300.00	21.8697	.84936	.12381	.10470	-.0000032
320.00	24.5744	.89475	.14765	.11982	-.0000034
340.00	27.8202	.95335	.17814	.13697	-.0000050
360.00	31.7533	1.02768	.21663	.15641	-.0000086
380.00	36.5489	1.12063	.26465	.17842	-.0000144
400.00	42.4138	1.23543	.32387	.20327	-.0000229
420.00	49.5908	1.37569	.39618	.23124	-.0000343
440.00	58.3624	1.54544	.48371	.26261	-.0000487
460.00	69.0562	1.74910	.58881	.29766	-.0000663

Normal Butane Isotherm at 650 K

20.00	1.7909	.96307	.08674	.00307	-.0000003
40.00	3.4784	.93524	.08212	.00659	-.0000011
60.00	5.0798	.91055	.07813	.01053	-.0000025
80.00	6.6084	.88842	.07489	.01487	-.0000040
100.00	8.0821	.86923	.07267	.01963	-.0000056
120.00	9.5236	.85355	.07171	.02482	-.0000070
140.00	10.9604	.84199	.07223	.03047	-.0000081
160.00	12.4241	.83513	.07446	.03666	-.0000087
180.00	13.9519	.83362	.07868	.04346	-.0000091
200.00	15.5862	.83814	.08515	.05099	-.0000091
220.00	17.3735	.84933	.09398	.05936	-.0000089
240.00	19.3603	.86758	.10510	.06871	-.0000086
260.00	21.5961	.89333	.11903	.07922	-.0000084
280.00	24.1467	.92749	.13674	.09104	-.0000084
300.00	27.0980	.97146	.15928	.10438	-.0000091
320.00	30.5577	1.02702	.18780	.11945	-.0000106
340.00	34.6584	1.09632	.22359	.13649	-.0000133
360.00	39.5589	1.18182	.26803	.15574	-.0000174
380.00	45.4475	1.28628	.32266	.17745	-.0000234
400.00	52.5446	1.41278	.38918	.20189	-.0000315
420.00	61.1064	1.56475	.46947	.22932	-.0000419
440.00	71.4292	1.74595	.56565	.26001	-.0000548

Table 18. (Continued).

Normal Butane Isotherm at 700 K

Density kg/m^3	Pressure MPa	Z	Isotherm Derivative $MPa \cdot m^3/kg$	Isochore Derivative MPa/K	Isochore Curvature MPa/K^2
20.00	1.9444	.97089	.09495	.00306	-.0000002
40.00	3.8064	.95035	.09138	.00654	-.0000009
60.00	5.6032	.93264	.08840	.01042	-.0000019
80.00	7.3475	.91723	.08618	.01470	-.0000031
100.00	9.0573	.90453	.08500	.01939	-.0000043
120.00	10.7565	.89518	.08516	.02451	-.0000055
140.00	12.4746	.88986	.08694	.03011	-.0000065
160.00	14.2467	.88924	.09062	.03626	-.0000073
180.00	16.1141	.89404	.09652	.04304	-.0000079
200.00	18.1245	.90502	.10496	.05055	-.0000083
220.00	20.3304	.92288	.11608	.05892	-.0000087
240.00	22.7850	.94812	.12985	.06827	-.0000092
260.00	25.5458	.98123	.14684	.07876	-.0000098
280.00	28.6870	1.02318	.16807	.09055	-.0000108
300.00	32.3040	1.07537	.19462	.10384	-.0000123
320.00	36.5153	1.13959	.22770	.11882	-.0000145
340.00	41.4642	1.21792	.26862	.13570	-.0000178
360.00	47.3217	1.31275	.31880	.15473	-.0000223
380.00	54.2884	1.42675	.37981	.17615	-.0000282
400.00	62.5974	1.56286	.45334	.20019	-.0000360

Table 19. The Joule-Thomson Inversion locus for normal butane.

Temp. K	Density kg/m3	Pressure MPa
350	511.2	2.707
360	505.9	5.384
370	500.6	7.911
380	495.4	10.297
390	490.2	12.551
400	485.0	14.680
410	479.9	16.693
420	474.7	18.595
430	469.7	20.394
440	464.7	22.095
450	459.7	23.703
460	454.8	25.224
470	449.9	26.661
480	445.0	28.020
490	440.2	29.304
500	435.5	30.517
510	430.8	31.662
520	426.1	32.743
530	421.5	33.762
540	416.9	34.723
550	412.3	35.627
560	407.8	36.477
570	403.4	37.275
580	398.9	38.025
590	394.5	38.726
600	390.2	39.381
610	385.8	39.991
620	381.5	40.560
630	377.3	41.087
640	373.0	41.575
650	368.8	42.024
660	364.6	42.436
670	360.5	42.812
680	356.4	43.154
690	352.3	43.462
700	348.2	43.738
710	344.1	43.981
720	340.1	44.196
730	336.1	44.380
740	332.1	44.537
750	328.1	44.666
760	324.1	44.768
770	320.2	44.845
780	316.3	44.898
790	312.4	44.927
800	308.5	44.934
810	304.6	44.919
820	300.8	44.884
830	297.0	44.828
840	293.2	44.754
850	289.4	44.662
860	285.6	44.553

Table 20. Thermophysical properties of saturated liquid normal butane.

Temp. K	P_σ MPa	ρ_ℓ kg/m3	ρ_g kg/m3	Z_ℓ	Z_g	dP_σ/dT MPa/K	$d\rho_\ell/dT$ kg/(m3•K)	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg
134.860	.67358E-06	735.27	.34916E-04	.00000	1.00000	.1282E-06	-.9441	2.1101	.2235E+01
140.000	.17210E-05	730.42	.85937E-04	.00000	.99999	.3012E-06	-.9424	2.0325	.2157E+01
145.000	.39917E-05	725.72	.19245E-03	.00000	.99998	.6456E-06	-.9410	1.9607	.2084E+01
150.000	.86943E-05	721.01	.40521E-03	.00000	.99997	.1303E-05	-.9401	1.8922	.2013E+01
155.000	.17897E-04	716.31	.80723E-03	.00000	.99994	.2490E-05	-.9395	1.8268	.1944E+01
160.000	.35012E-04	711.62	.15299E-02	.00000	.99990	.4532E-05	-.9394	1.7642	.1878E+01
165.000	.65411E-04	706.92	.27718E-02	.00000	.99983	.7895E-05	-.9396	1.7042	.1814E+01
170.000	.11721E-03	702.22	.48211E-02	.00001	.99973	.1321E-04	-.9403	1.6467	.1751E+01
175.000	.20220E-03	697.52	.80807E-02	.00001	.99958	.2133E-04	-.9414	1.5914	.1690E+01
180.000	.33697E-03	692.81	.13095E-01	.00002	.99937	.3332E-04	-.9430	1.5382	.1631E+01
185.000	.54411E-03	688.09	.20580E-01	.00003	.99907	.5053E-04	-.9450	1.4870	.1574E+01
190.000	.85357E-03	683.36	.31447E-01	.00005	.99868	.7454E-04	-.9474	1.4377	.1517E+01
195.000	.13040E-02	678.61	.46834E-01	.00007	.99816	.1073E-03	-.9504	1.3900	.1462E+01
200.000	.19442E-02	673.85	.68126E-01	.00010	.99751	.1508E-03	-.9538	1.3441	.1409E+01
205.000	.28345E-02	669.07	.96980E-01	.00014	.99669	.2077E-03	-.9578	1.2996	.1357E+01
210.000	.40479E-02	664.27	.13534E+00	.00020	.99568	.2806E-03	-.9623	1.2566	.1306E+01
215.000	.56716E-02	659.45	.18544E+00	.00028	.99447	.3723E-03	-.9673	1.2149	.1256E+01
220.000	.78076E-02	654.60	.24984E+00	.00038	.99302	.4860E-03	-.9729	1.1746	.1207E+01
225.000	.10574E-01	649.72	.33139E+00	.00051	.99133	.6249E-03	-.9791	1.1354	.1159E+01
230.000	.14104E-01	644.80	.43328E+00	.00066	.98937	.7923E-03	-.9860	1.0974	.1112E+01
235.000	.18550E-01	639.86	.55901E+00	.00086	.98712	.9916E-03	-.9934	1.0604	.1066E+01
240.000	.24079E-01	634.87	.71237E+00	.00110	.98456	.1226E-02	-1.0016	1.0245	.1022E+01
245.000	.30877E-01	629.84	.89748E+00	.00140	.98168	.1500E-02	-1.0104	.9896	.9779E+00
250.000	.39147E-01	624.76	.11188E+01	.00175	.97845	.1815E-02	-1.0201	.9556	.9350E+00
255.000	.49106E-01	619.64	.13809E+01	.00217	.97486	.2176E-02	-1.0304	.9225	.8931E+00
260.000	.60989E-01	614.46	.16890E+01	.00267	.97089	.2586E-02	-1.0417	.8902	.8521E+00
265.000	.75047E-01	609.22	.20483E+01	.00325	.96651	.3046E-02	-1.0538	.8587	.8120E+00
270.000	.91543E-01	603.92	.24646E+01	.00392	.96170	.3562E-02	-1.0669	.8279	.7727E+00
272.638	.10133E+00	601.09	.27092E+01	.00432	.95898	.3856E-02	-1.0741	.8120	.7524E+00
280.000	.13298E+00	593.11	.34923E+01	.00560	.95069	.4765E-02	-1.0961	.7686	.6969E+00
285.000	.15851E+00	587.59	.41169E+01	.00662	.94443	.5459E-02	-1.1124	.7399	.6603E+00
290.000	.18767E+00	581.98	.48249E+01	.00777	.93764	.6216E-02	-1.1299	.7119	.6245E+00
295.000	.22078E+00	576.29	.56240E+01	.00908	.93028	.7039E-02	-1.1488	.6844	.5896E+00
300.000	.25817E+00	570.49	.65226E+01	.01055	.92233	.7929E-02	-1.1693	.6575	.5556E+00
305.000	.30019E+00	564.59	.75297E+01	.01219	.91377	.8888E-02	-1.1913	.6312	.5224E+00
310.000	.34717E+00	558.57	.86549E+01	.01402	.90457	.9918E-02	-1.2151	.6054	.4900E+00
315.000	.39949E+00	552.44	.99090E+01	.01605	.89471	.1102E-01	-1.2409	.5800	.4586E+00
320.000	.45749E+00	546.16	.11303E+02	.01830	.88418	.1219E-01	-1.2688	.5552	.4279E+00
325.000	.52155E+00	539.74	.12851E+02	.02078	.87297	.1344E-01	-1.2993	.5308	.3982E+00
330.000	.59204E+00	533.17	.14565E+02	.02352	.86107	.1477E-01	-1.3325	.5068	.3693E+00
335.000	.66934E+00	526.41	.16462E+02	.02653	.84846	.1617E-01	-1.3688	.4832	.3412E+00
340.000	.75384E+00	519.47	.18560E+02	.02984	.83513	.1765E-01	-1.4087	.4600	.3140E+00
345.000	.84593E+00	512.32	.20876E+02	.03346	.82107	.1920E-01	-1.4528	.4372	.2877E+00
350.000	.94601E+00	504.93	.23436E+02	.03742	.80625	.2084E-01	-1.5018	.4147	.2623E+00
355.000	.10545E+01	497.29	.26264E+02	.04176	.79065	.2257E-01	-1.5565	.3926	.2377E+00
360.000	.11718E+01	489.36	.29391E+02	.04650	.77422	.2438E-01	-1.6180	.3707	.2141E+00
365.000	.12984E+01	481.10	.32855E+02	.05169	.75690	.2628E-01	-1.6878	.3491	.1913E+00
370.000	.14348E+01	472.46	.36701E+02	.05738	.73862	.2828E-01	-1.7677	.3278	.1694E+00
375.000	.15814E+01	463.40	.40985E+02	.06362	.71928	.3038E-01	-1.8606	.3067	.1485E+00
380.000	.17387E+01	453.83	.45778E+02	.07048	.69873	.3259E-01	-1.9698	.2857	.1285E+00
385.000	.19075E+01	443.67	.51175E+02	.07807	.67680	.3493E-01	-2.1008	.2649	.1095E+00
390.000	.20883E+01	432.77	.57302E+02	.08649	.65325	.3741E-01	-2.2615	.2441	.9141E-01
395.000	.22819E+01	420.98	.64336E+02	.09593	.62772	.4006E-01	-2.4645	.2234	.7438E-01
400.000	.24892E+01	408.02	.72539E+02	.10662	.59973	.4290E-01	-2.7314	.2025	.5843E-01
405.000	.27113E+01	393.49	.82323E+02	.11894	.56850	.4599E-01	-3.1026	.1813	.4362E-01
410.000	.29496E+01	376.69	.94398E+02	.13351	.53278	.4939E-01	-3.6648	.1596	.3006E-01
415.000	.32060E+01	356.17	.11019E+03	.15163	.49012	.5323E-01	-4.6508	.1367	.1794E-01
420.000	.34830E+01	328.06	.13347E+03	.17672	.43436	.5774E-01	-7.0294	.1112	.7604E-02
425.160	.37960E+01	227.85	.22785E+03	.27394	.27394	.6427E-01	--	.0643	0.

Table 20. (Continued)

Temp. K	Heat of Vap. J/mol	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_σ J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
134.860	28789.2	.0	.0	133.544	88.51	117.39	117.39	1.00000	1721	2.03857
140.000	28520.6	602.8	602.8	137.932	87.86	117.07	117.07	1.00000	1695	2.03023
145.000	28265.6	1187.8	1187.8	142.036	87.29	116.82	116.82	1.00000	1669	2.02212
150.000	28016.2	1771.6	1771.6	145.992	86.78	116.61	116.61	1.00000	1644	2.01402
155.000	27772.2	2354.7	2354.7	149.812	86.34	116.48	116.48	.99998	1619	2.00592
160.000	27532.9	2937.3	2937.3	153.507	85.99	.42	116.42	.99994	1594	1.99783
165.000	27298.0	3519.8	3519.8	157.089	85.71	116.44	116.44	.99986	1569	1.98975
170.000	27067.1	4102.5	4102.5	160.565	85.51	116.54	116.54	.99975	1544	1.98167
175.000	26839.7	4686.0	4686.0	163.945	85.40	116.72	116.72	.99959	1520	1.97359
180.000	26615.3	5270.5	5270.5	167.237	85.37	116.99	116.99	.99935	1495	1.96551
185.000	26393.4	5856.5	5856.5	170.447	85.42	117.34	117.34	.99902	1470	1.95742
190.000	26173.7	6444.4	6444.5	173.582	85.56	117.77	117.77	.99858	1445	1.94932
195.000	25955.7	7034.6	7034.8	176.649	85.77	118.28	118.28	.99799	1420	1.94122
200.000	25738.9	7627.6	7627.7	179.652	86.05	118.88	118.88	.99722	1395	1.93310
205.000	25522.8	8223.6	8223.9	182.596	86.41	119.54	119.55	.99636	1369	1.92496
210.000	25307.0	8823.1	8823.4	185.486	86.84	120.29	120.29	.99521	1344	1.91680
215.000	25091.1	9426.5	9427.0	188.326	87.33	121.10	121.11	.99392	1319	1.90862
220.000	24874.5	10033.9	10034.6	191.120	87.88	121.98	121.99	.99228	1294	1.90041
225.000	24656.8	10646.0	10646.9	193.872	88.48	122.92	122.94	.99045	1268	1.89216
230.000	24437.6	11262.7	11264.0	196.584	89.13	123.92	123.95	.98826	1243	1.88388
235.000	24216.2	11884.7	11886.4	199.260	89.84	124.98	125.02	.98581	1218	1.87556
240.000	23992.3	12512.1	12514.3	201.902	90.58	126.10	126.14	.98298	1192	1.86719
245.000	23765.3	13145.3	13148.1	204.513	91.37	127.26	127.32	.97985	1167	1.85877
250.000	23534.8	13784.4	13788.0	207.096	92.19	128.48	128.55	.97634	1141	1.85030
255.000	23300.2	14429.8	14434.4	209.652	93.05	129.74	129.83	.97247	1116	1.84177
260.000	23061.1	15081.7	15087.5	212.183	93.93	131.05	131.16	.96823	1090	1.83316
265.000	22816.8	15740.5	15747.6	214.692	94.85	132.40	132.53	.96368	1065	1.82449
270.000	22566.9	16406.1	16415.0	217.180	95.78	133.79	133.96	.95872	1039	1.81574
272.638	22432.6	16760.3	16770.1	218.485	96.29	134.54	134.73	.95595	1026	1.81108
280.000	22047.9	17759.4	17772.4	222.098	97.73	136.70	136.95	.94773	988	1.79796
285.000	21777.7	18447.2	18462.9	224.532	98.73	138.22	138.51	.94166	962	1.78893
290.000	21499.6	19142.8	19161.5	226.950	99.75	139.78	140.13	.93523	936	1.77978
295.000	21212.8	19846.3	19868.5	229.353	100.78	141.38	141.80	.92843	910	1.77052
300.000	20916.9	20557.9	20584.2	231.744	101.83	143.02	143.53	.92130	884	1.76113
305.000	20611.0	21277.7	21308.6	234.122	102.89	144.71	145.31	.91379	858	1.75160
310.000	20294.4	22005.9	22042.0	236.490	103.96	146.44	147.15	.90593	832	1.74192
315.000	19966.5	22742.6	22784.6	238.847	105.04	148.22	149.06	.89772	806	1.73208
320.000	19626.4	23488.1	23536.8	241.196	106.13	150.05	151.04	.88919	780	1.72206
325.000	19273.1	24242.7	24298.8	243.536	107.22	151.94	153.10	.88036	754	1.71184
330.000	18905.8	25006.4	25070.9	245.870	108.31	153.88	155.24	.87120	727	1.70142
335.000	18523.4	25779.6	25853.6	248.198	109.40	155.87	157.48	.86176	700	1.69076
340.000	18124.8	26562.7	26647.1	250.521	110.48	157.94	159.83	.85204	674	1.67986
345.000	17708.7	27356.0	27452.0	252.842	111.55	160.08	162.31	.84207	647	1.66867
350.000	17273.6	28159.9	28268.8	255.160	112.60	162.29	164.92	.83187	619	1.65717
355.000	16817.9	28975.0	29098.2	257.478	113.62	164.61	167.71	.82147	592	1.64533
360.000	16339.6	29801.5	29940.7	259.797	114.62	167.03	170.71	.81086	564	1.63310
365.000	15836.5	30640.3	30797.2	262.119	115.57	169.58	173.97	.80007	536	1.62044
370.000	15305.8	31491.9	31668.4	264.446	116.46	172.29	177.56	.78911	508	1.60727
375.000	14744.1	32357.3	32555.6	266.779	117.30	175.21	181.58	.77799	479	1.59353
380.000	14147.3	33237.3	33460.0	269.122	118.05	178.40	186.17	.76672	450	1.57912
385.000	13509.7	34133.4	34383.3	271.479	118.70	181.96	191.57	.75532	420	1.56392
390.000	12824.0	35047.2	35327.6	273.854	119.23	186.05	198.14	.74375	389	1.54774
395.000	12079.8	35981.2	36296.3	276.254	119.60	190.91	206.50	.73200	358	1.53036
400.000	11262.1	36939.3	37293.9	278.689	119.75	196.99	217.75	.72005	325	1.51143
405.000	10346.6	37927.9	38328.4	281.178	119.57	205.10	234.17	.70785	292	1.49041
410.000	9291.7	38959.2	39414.3	283.753	118.84	217.06	261.09	.69533	257	1.46636
415.000	8012.0	40060.4	40583.6	286.487	116.84	237.72	314.81	.68240	219	1.43739
420.000	6273.2	41315.5	41932.6	289.604	110.53	287.81	479.31	.66883	181	1.39841
425.160	0.0	44431.5	45399.9	297.647	--	--	--	.65361	0	1.26583

Table 21. Thermophysical properties of normal butane along isobars.

Normal Butane Isobar at P = 0.01 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	Cv J/(mol•K)	Cp J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
134.862	.1265E+02	.73528E+03	.00070	2.110097	2.23502	.1	.9	133.544	88.51	117.39	.67427E-04	1721	2.03858
140.000	.1257E+02	.73043E+03	.00068	2.032560	2.15694	602.8	603.6	137.928	87.86	117.07	.17231E-03	1695	2.03023
150.000	.1240E+02	.72102E+03	.00065	1.892281	2.01297	1771.5	1772.3	145.988	86.78	116.61	.87029E-03	1644	2.01402
160.000	.1224E+02	.71162E+03	.00061	1.764248	1.87820	2937.0	2937.8	153.506	85.99	116.42	.35028E-02	1594	1.99784
170.000	.1208E+02	.70223E+03	.00059	1.646711	1.75132	4102.3	4103.1	160.566	85.51	116.54	.11721E-01	1544	1.98168
180.000	.1192E+02	.69281E+03	.00056	1.538251	1.63134	5270.3	5271.2	167.238	85.37	116.99	.33685E-01	1495	1.96551
190.000	.1176E+02	.68336E+03	.00054	1.437702	1.51746	6444.4	6445.2	173.583	85.56	117.77	.85272E-01	1445	1.94933
200.000	.1159E+02	.67386E+03	.00052	1.344094	1.40905	7627.5	7628.4	179.650	86.05	118.88	.19399E+00	1395	1.93310
210.000	.1143E+02	.66428E+03	.00050	1.256612	1.30561	8823.0	8823.8	185.483	86.84	120.29	.40306E+00	1344	1.91681
220.000	.1126E+02	.65460E+03	.00049	1.174561	1.20674	10033.7	10034.6	191.118	87.88	121.99	.77493E+00	1294	1.90041
224.061	.1119E+02	.65064E+03	.00048	1.142653	1.16782	10530.7	10531.6	193.358	88.36	122.76	.99083E+00	1273	1.89371
224.061	.5413E-02	.31462E+00	.99167	.000045	.03154	33382.0	35229.4	303.586	73.02	81.58	.99083E+00	187	1.00033
230.000	.5270E-02	.30633E+00	.99222	.000044	.03241	33820.0	35717.5	305.736	74.26	82.79	.99139E+00	190	1.00033
240.000	.5047E-02	.29333E+00	.99302	.000042	.03388	34574.4	36555.9	309.304	76.43	84.92	.99222E+00	194	1.00031
250.000	.4841E-02	.28140E+00	.99369	.000040	.03534	35350.7	37416.2	312.816	78.67	87.15	.99293E+00	197	1.00030
260.000	.4653E-02	.27043E+00	.99426	.000039	.03679	36149.8	38299.1	316.278	80.99	89.45	.99354E+00	201	1.00029
270.000	.4478E-02	.26028E+00	.99476	.000037	.03824	36972.2	39205.4	319.698	83.37	91.81	.99408E+00	205	1.00028
280.000	.4316E-02	.25088E+00	.99519	.000036	.03969	37818.6	40135.5	323.080	85.79	94.22	.99455E+00	208	1.00027
290.000	.4166E-02	.24213E+00	.99557	.000035	.04114	38689.4	41090.0	326.429	88.26	96.68	.99496E+00	212	1.00026
300.000	.4026E-02	.23398E+00	.99590	.000034	.04259	39585.1	42069.2	329.749	90.76	99.17	.99533E+00	215	1.00025
310.000	.3895E-02	.22637E+00	.99620	.000032	.04403	40505.8	43073.5	333.042	93.29	101.69	.99566E+00	219	1.00024
320.000	.3772E-02	.21924E+00	.99646	.000031	.04548	41451.8	44103.0	336.310	95.83	104.23	.99595E+00	222	1.00023
330.000	.3657E-02	.21254E+00	.99670	.000030	.04692	42423.3	45158.1	339.556	98.39	106.78	.99622E+00	225	1.00023
340.000	.3548E-02	.20624E+00	.99692	.000030	.04836	43420.4	46238.7	342.782	100.96	109.34	.99646E+00	228	1.00022
350.000	.3446E-02	.20031E+00	.99711	.000029	.04980	44443.2	47344.9	345.988	103.52	111.90	.99668E+00	232	1.00021
360.000	.3350E-02	.19471E+00	.99729	.000028	.05124	45491.5	48476.7	349.177	106.08	114.46	.99688E+00	235	1.00021
370.000	.3259E-02	.18942E+00	.99745	.000027	.05268	46565.4	49633.9	352.348	108.64	117.01	.99704E+00	238	1.00020
380.000	.3173E-02	.18441E+00	.99760	.000026	.05412	47664.8	50816.8	355.502	111.19	119.55	.99721E+00	241	1.00020
390.000	.3091E-02	.17966E+00	.99774	.000026	.05556	48789.6	52025.0	358.640	113.72	122.08	.99736E+00	244	1.00019
400.000	.3013E-02	.17514E+00	.99786	.000025	.05699	49939.7	53258.3	361.762	116.23	124.59	.99750E+00	247	1.00019
410.000	.2939E-02	.17085E+00	.99798	.000024	.05843	51114.7	54516.8	364.870	118.73	127.09	.99764E+00	250	1.00018
420.000	.2869E-02	.16677E+00	.99808	.000024	.05987	52314.6	55800.0	367.962	121.20	129.56	.99776E+00	252	1.00018
430.000	.2802E-02	.16287E+00	.99818	.000023	.06131	53539.1	57107.9	371.039	123.65	132.01	.99787E+00	255	1.00017
440.000	.2738E-02	.15915E+00	.99827	.000023	.06274	54788.0	58440.1	374.102	126.08	134.43	.99798E+00	258	1.00017
450.000	.2677E-02	.15560E+00	.99836	.000022	.06418	56061.0	59796.4	377.150	128.48	136.83	.99807E+00	261	1.00017
460.000	.2619E-02	.15221E+00	.99844	.000022	.06561	57357.9	61176.6	380.183	130.85	139.20	.99817E+00	264	0.00000
470.000	.2563E-02	.14896E+00	.99851	.000021	.06705	58678.4	62580.4	383.202	133.20	141.55	.99825E+00	266	0.00000
480.000	.2509E-02	.14585E+00	.99858	.000021	.06848	60022.1	64007.4	386.206	135.51	143.86	.99833E+00	269	0.00000
490.000	.2458E-02	.14286E+00	.99864	.000020	.06992	61388.9	65457.5	389.196	137.80	146.15	.99841E+00	272	0.00000
500.000	.2409E-02	.14000E+00	.99870	.000020	.07135	62778.4	66930.3	392.171	140.06	148.40	.99848E+00	274	0.00000
520.000	.2316E-02	.13460E+00	.99881	.000019	.07422	65624.3	69942.7	398.078	144.48	152.82	.99860E+00	280	0.00000
540.000	.2230E-02	.12960E+00	.99891	.000019	.07709	68557.4	73042.4	403.927	148.78	157.12	.99872E+00	285	0.00000
560.000	.2150E-02	.12496E+00	.99900	.000018	.07996	71575.3	76226.8	409.717	152.96	161.30	.99882E+00	290	0.00000
580.000	.2076E-02	.12064E+00	.99907	.000017	.08283	74675.5	79493.5	415.448	157.02	165.35	.99891E+00	295	0.00000
620.000	.1941E-02	.11284E+00	.99920	.000016	.08856	81113.3	86264.2	426.734	164.77	173.10	.99906E+00	305	0.00000
660.000	.1824E-02	.10599E+00	.99931	.000015	.09429	87851.8	93335.6	437.784	172.06	180.39	.99918E+00	314	0.00000
700.000	.1719E-02	.99927E-01	.99940	.000014	.10002	94873.1	100689.8	448.600	178.92	187.25	.99929E+00	323	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 0.05 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	Cv J/(mol•K)	Cp J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
134.868	.1265E+02	.73529E+03	.00352	2.110130	2.23536	.3	4.3	133.546	88.51	117.39	.13541E-04	1721	2.03860
140.000	.1257E+02	.73045E+03	.00342	2.032702	2.15739	602.2	606.2	137.924	87.86	117.07	.34556E-04	1695	2.03026
150.000	.1241E+02	.72104E+03	.00323	1.892431	2.01343	1770.8	1774.9	145.984	86.78	116.61	.17451E-03	1644	2.01406
160.000	.1224E+02	.71164E+03	.00307	1.764405	1.87866	2936.3	2940.4	153.502	85.99	116.42	.70227E-03	1594	1.99788
170.000	.1208E+02	.70225E+03	.00293	1.646875	1.75180	4101.5	4105.6	160.562	85.51	116.53	.23497E-02	1545	1.98172
180.000	.1192E+02	.69284E+03	.00280	1.538422	1.63183	5269.5	5273.7	167.234	85.37	116.98	.67521E-02	1495	1.96555
190.000	.1176E+02	.68339E+03	.00269	1.437880	1.51796	6443.5	6447.7	173.578	85.56	117.77	.17091E-01	1445	1.94937
200.000	.1159E+02	.67388E+03	.00259	1.344279	1.40956	7626.6	7630.9	179.645	86.06	118.87	.38879E-01	1395	1.93315
210.000	.1143E+02	.66431E+03	.00251	1.256804	1.30613	8821.9	8826.3	185.478	86.84	120.29	.80774E-01	1345	1.91686
220.000	.1126E+02	.65463E+03	.00243	1.174762	1.20728	10032.5	10037.0	191.112	87.88	121.99	.15529E+00	1294	1.90046
230.000	.1109E+02	.64484E+03	.00236	1.097556	1.11267	11261.3	11265.8	196.577	89.14	123.94	.27925E+00	1243	1.88393
240.000	.1092E+02	.63489E+03	.00229	1.024671	1.02204	12510.9	12515.5	201.898	90.58	126.14	.47390E+00	1192	1.86723
250.000	.1075E+02	.62478E+03	.00224	.955657	.93519	13783.8	13788.5	207.095	92.19	128.55	.76464E+00	1141	1.85032
255.408	.1065E+02	.61922E+03	.00221	.919804	.88972	14482.7	14487.4	209.859	93.12	129.93	.97213E+00	1114	1.84107
255.408	.2416E-01	.14043E+01	.97455	.000206	.03475	35698.8	37768.3	301.011	80.44	89.60	.97213E+00	196	1.00149
260.000	.2370E-01	.13777E+01	.97583	.000201	.03548	36072.4	38181.9	302.616	81.43	90.53	.97340E+00	198	1.00146
270.000	.2277E-01	.13233E+01	.97827	.000193	.03703	36901.7	39097.8	306.072	83.69	92.68	.97580E+00	202	1.00141
280.000	.2191E-01	.12734E+01	.98032	.000185	.03857	37753.6	40035.8	309.483	86.05	94.94	.97787E+00	206	1.00135
290.000	.2112E-01	.12273E+01	.98208	.000178	.04009	38628.9	40996.9	312.856	88.46	97.29	.97967E+00	209	1.00131
300.000	.2038E-01	.11846E+01	.98359	.000171	.04160	39528.4	41981.8	316.194	90.93	99.70	.98126E+00	213	1.00126
310.000	.1970E-01	.11448E+01	.98492	.000165	.04310	40452.4	42991.0	319.503	93.42	102.15	.98266E+00	217	1.00122
320.000	.1906E-01	.11077E+01	.98609	.000160	.04460	41401.3	44024.9	322.785	95.95	104.63	.98391E+00	220	1.00118
330.000	.1846E-01	.10730E+01	.98712	.000155	.04609	42375.3	45083.8	326.044	98.49	107.14	.98503E+00	223	1.00114
340.000	.1790E-01	.10405E+01	.98805	.000150	.04757	43374.7	46167.8	329.280	101.04	109.67	.98603E+00	227	1.00111
350.000	.1738E-01	.10099E+01	.98887	.000145	.04905	44399.4	47277.1	332.495	103.59	112.20	.98694E+00	230	1.00107
360.000	.1688E-01	.98112E+00	.98962	.000141	.05052	45449.6	48411.8	335.691	106.15	114.73	.98776E+00	233	1.00104
370.000	.1641E-01	.95396E+00	.99029	.000137	.05199	46525.1	49571.6	338.869	108.70	117.26	.98849E+00	236	1.00102
380.000	.1597E-01	.92828E+00	.99090	.000134	.05346	47626.1	50756.8	342.030	111.23	119.78	.98917E+00	239	1.00099
390.000	.1555E-01	.90397E+00	.99145	.000130	.05492	48752.2	51967.2	345.173	113.76	122.29	.98980E+00	242	1.00096
400.000	.1516E-01	.88092E+00	.99196	.000127	.05639	49903.5	53202.6	348.301	116.27	124.79	.99037E+00	246	1.00094
410.000	.1478E-01	.85903E+00	.99242	.000123	.05785	51079.8	54462.9	351.413	118.76	127.27	.99090E+00	248	1.00091
420.000	.1442E-01	.83822E+00	.99285	.000120	.05931	52280.7	55747.9	354.509	121.23	129.73	.99139E+00	251	1.00089
430.000	.1408E-01	.81840E+00	.99324	.000118	.06076	53506.3	57057.3	357.590	123.68	132.16	.99184E+00	254	1.00087
440.000	.1376E-01	.79951E+00	.99361	.000115	.06222	54756.1	58391.1	360.656	126.11	134.58	.99226E+00	257	1.00085
450.000	.1344E-01	.78148E+00	.99394	.000112	.06367	56030.0	59748.9	363.708	128.50	136.97	.99265E+00	260	1.00083
460.000	.1315E-01	.76425E+00	.99425	.000110	.06513	57327.7	61130.4	366.744	130.87	139.33	.99301E+00	263	0.00000
470.000	.1287E-01	.74778E+00	.99454	.000107	.06658	58649.0	62535.4	369.766	133.22	141.67	.99335E+00	266	0.00000
480.000	.1259E-01	.73200E+00	.99481	.000105	.06803	59993.5	63963.7	372.773	135.53	143.98	.99366E+00	268	0.00000
490.000	.1233E-01	.71688E+00	.99506	.000103	.06948	61360.9	65414.9	375.765	137.82	146.26	.99395E+00	271	0.00000
500.000	.1208E-01	.70238E+00	.99529	.000101	.07093	62751.1	66888.8	378.742	140.07	148.51	.99423E+00	274	0.00000
520.000	.1161E-01	.67507E+00	.99572	.000097	.07382	65598.2	69903.3	384.653	144.50	152.92	.99473E+00	279	0.00000
540.000	.1118E-01	.64983E+00	.99609	.000093	.07671	68532.5	73004.7	390.505	148.79	157.21	.99517E+00	284	0.00000
560.000	.1078E-01	.62641E+00	.99642	.000090	.07960	71551.4	76190.8	396.298	152.97	161.38	.99556E+00	289	0.00000
580.000	.1040E-01	.60464E+00	.99671	.000087	.08249	74652.5	79459.1	402.032	157.03	165.43	.99591E+00	294	0.00000
620.000	.9727E-02	.56535E+00	.99721	.000081	.08826	81091.9	86232.5	413.322	164.78	173.17	.99650E+00	304	0.00000
660.000	.9133E-02	.53087E+00	.99761	.000076	.09402	87831.8	93306.3	424.376	172.07	180.45	.99698E+00	314	0.00000
700.000	.8609E-02	.50037E+00	.99794	.000072	.09978	94854.4	100662.5	435.196	178.92	187.29	.99738E+00	323	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 0.101325 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
134.877	.1265E+02	.73530E+03	.00714	2.110173	2.23579	.6	8.6	133.548	88.51	117.39	.67171E-05	1721	2.03862
140.000	.1257E+02	.73047E+03	.00693	2.032884	2.15796	601.5	609.5	137.918	87.87	117.07	.17112E-04	1695	2.03030
150.000	.1241E+02	.72106E+03	.00655	1.892623	2.01401	1770.0	1778.2	145.978	86.79	116.61	.86400E-04	1645	2.01410
160.000	.1224E+02	.71167E+03	.00622	1.764607	1.87926	2935.4	2943.7	153.496	85.99	116.42	.34764E-03	1595	1.99792
170.000	.1208E+02	.70228E+03	.00593	1.647086	1.75241	4100.5	4108.9	160.556	85.52	116.53	.11630E-02	1545	1.98176
180.000	.1192E+02	.69287E+03	.00568	1.538642	1.63245	5268.5	5277.0	167.228	85.37	116.98	.33415E-02	1495	1.96561
190.000	.1176E+02	.68342E+03	.00546	1.438109	1.51859	6442.3	6451.0	173.572	85.56	117.76	.84571E-02	1445	1.94943
200.000	.1159E+02	.67392E+03	.00526	1.344517	1.41021	7625.3	7634.1	179.639	86.06	118.87	.19236E-01	1395	1.93321
210.000	.1143E+02	.66435E+03	.00508	1.257051	1.30680	8820.5	8829.4	185.472	86.84	120.28	.39961E-01	1345	1.91692
220.000	.1126E+02	.65467E+03	.00492	1.175018	1.20796	10031.0	10040.0	191.106	87.88	121.98	.76820E-01	1294	1.90053
230.000	.1109E+02	.64488E+03	.00478	1.097823	1.11337	11259.7	11268.8	196.570	89.14	123.94	.13813E+00	1244	1.88401
240.000	.1092E+02	.63494E+03	.00465	1.024950	1.02277	12509.1	12518.4	201.890	90.59	126.13	.23440E+00	1193	1.86732
250.000	.1075E+02	.62483E+03	.00453	.955949	.93593	13781.9	13791.3	207.087	92.19	128.54	.37819E+00	1142	1.85041
260.000	.1057E+02	.61451E+03	.00443	.890420	.85268	15080.1	15089.7	212.179	93.93	131.15	.58373E+00	1091	1.83324
270.000	.1039E+02	.60393E+03	.00434	.828009	.77288	16405.9	16415.7	217.180	95.79	133.95	.86640E+00	1039	1.81576
272.638	.1034E+02	.60109E+03	.00432	.812021	.75238	16760.3	16770.1	218.485	96.29	134.73	.95595E+00	1026	1.81108
272.638	.4661E-01	.27092E+01	.95898	.000404	.03590	37028.8	39202.7	300.764	84.98	94.82	.95595E+00	200	1.00288
280.000	.4523E-01	.26291E+01	.96221	.000390	.03714	37665.7	39905.8	303.308	86.57	96.22	.95897E+00	203	1.00280
290.000	.4350E-01	.25286E+01	.96595	.000373	.03879	38549.2	40878.3	306.721	88.85	98.31	.96251E+00	207	1.00269
300.000	.4192E-01	.24364E+01	.96911	.000358	.04040	39455.1	41872.4	310.091	91.23	100.54	.96558E+00	211	1.00259
310.000	.4045E-01	.23512E+01	.97184	.000344	.04199	40384.5	42889.4	313.425	93.67	102.86	.96828E+00	214	1.00250
320.000	.3909E-01	.22722E+01	.97420	.000332	.04356	41337.9	43929.9	316.728	96.15	105.25	.97067E+00	218	1.00242
330.000	.3783E-01	.21986E+01	.97627	.000320	.04511	42315.8	44994.5	320.004	98.65	107.68	.97279E+00	221	1.00234
340.000	.3665E-01	.21300E+01	.97809	.000310	.04666	43318.5	46083.5	323.255	101.18	110.13	.97469E+00	225	1.00227
350.000	.3554E-01	.20657E+01	.97971	.000300	.04819	44346.2	47197.2	326.483	103.71	112.61	.97640E+00	228	1.00220
360.000	.3450E-01	.20054E+01	.98116	.000291	.04971	45399.0	48335.8	329.691	106.25	115.10	.97794E+00	232	1.00213
370.000	.3352E-01	.19486E+01	.98246	.000282	.05122	46476.8	49499.2	332.878	108.78	117.59	.97931E+00	235	1.00207
380.000	.3260E-01	.18951E+01	.98363	.000274	.05273	47579.8	50687.6	336.047	111.31	120.09	.98058E+00	238	1.00202
390.000	.3173E-01	.18445E+01	.98469	.000267	.05423	48707.9	51900.9	339.199	113.83	122.57	.98174E+00	241	1.00196
400.000	.3091E-01	.17966E+01	.98565	.000260	.05573	49860.9	53139.0	342.333	116.33	125.04	.98281E+00	244	1.00191
410.000	.3013E-01	.17512E+01	.98653	.000253	.05722	51038.7	54401.7	345.451	118.82	127.50	.98378E+00	247	1.00186
420.000	.2939E-01	.17081E+01	.98733	.000247	.05870	52241.1	55689.0	348.553	121.28	129.94	.98468E+00	250	1.00182
430.000	.2868E-01	.16672E+01	.98807	.000241	.06019	53468.0	57000.6	351.639	123.73	132.37	.98551E+00	253	1.00178
440.000	.2801E-01	.16282E+01	.98874	.000235	.06167	54719.1	58336.3	354.710	126.14	134.77	.98627E+00	256	1.00173
450.000	.2737E-01	.15910E+01	.98937	.000229	.06314	55994.1	59695.9	357.765	128.54	137.15	.98698E+00	259	1.00169
460.000	.2676E-01	.15555E+01	.98994	.000224	.06462	57292.9	61079.1	360.805	130.91	139.50	.98764E+00	262	0.00000
470.000	.2618E-01	.15216E+01	.99048	.000219	.06609	58615.1	62485.7	363.830	133.25	141.82	.98825E+00	265	0.00000
480.000	.2562E-01	.14891E+01	.99097	.000214	.06756	59960.6	63915.5	366.840	135.56	144.12	.98882E+00	268	0.00000
490.000	.2509E-01	.14581E+01	.99143	.000210	.06903	61328.9	65368.1	369.835	137.84	146.39	.98935E+00	270	0.00000
500.000	.2457E-01	.14283E+01	.99186	.000206	.07049	62719.9	66843.3	372.815	140.10	148.64	.98985E+00	273	0.00000
520.000	.2361E-01	.13723E+01	.99263	.000197	.07342	65568.6	69860.2	378.731	144.52	153.03	.99075E+00	278	0.00000
540.000	.2272E-01	.13206E+01	.99330	.000190	.07634	68504.2	72963.9	384.587	148.81	157.31	.99155E+00	284	0.00000
560.000	.2190E-01	.12726E+01	.99390	.000183	.07925	71524.3	76152.0	390.384	152.99	161.47	.99225E+00	289	0.00000
580.000	.2113E-01	.12281E+01	.99442	.000176	.08216	74626.6	79422.1	396.121	157.04	165.51	.99288E+00	294	0.00000
620.000	.1975E-01	.11479E+01	.99531	.000165	.08797	81067.9	86198.7	407.417	164.79	173.24	.99394E+00	304	0.00000
660.000	.1854E-01	.10775E+01	.99602	.000155	.09377	87809.5	93275.2	418.475	172.08	180.51	.99480E+00	313	0.00000
700.000	.1747E-01	.10154E+01	.99659	.000146	.09956	94833.5	100633.8	429.298	178.93	187.35	.99551E+00	322	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 0.15 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	Cv J/(mol•K)	Cp J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
134.885	.1265E+02	.73532E+03	.01057	2.110214	2.23620	.9	12.8	133.550	88.51	117.38	.45600E-05	1722	2.03864
140.000	.1257E+02	.73049E+03	.01025	2.033057	2.15850	600.8	612.7	137.913	87.87	117.07	.11598E-04	1695	2.03034
150.000	.1241E+02	.72109E+03	.00969	1.892806	2.01456	1769.3	1781.4	145.973	86.79	116.61	.58547E-04	1645	2.01414
160.000	.1224E+02	.71170E+03	.00921	1.764799	1.87982	2934.6	2946.8	153.491	85.99	116.41	.23553E-03	1595	1.99796
170.000	.1208E+02	.70231E+03	.00878	1.647286	1.75298	4099.6	4112.0	160.551	85.52	116.53	.78784E-03	1545	1.98181
180.000	.1192E+02	.69290E+03	.00841	1.538850	1.63304	5267.5	5280.0	167.222	85.38	116.98	.22634E-02	1495	1.96565
190.000	.1176E+02	.68345E+03	.00808	1.438325	1.51920	6441.2	6454.0	173.566	85.56	117.76	.57278E-02	1445	1.94948
200.000	.1160E+02	.67396E+03	.00778	1.344742	1.41083	7624.1	7637.1	179.633	86.06	118.87	.13027E-01	1395	1.93327
210.000	.1143E+02	.66438E+03	.00752	1.257285	1.30744	8819.2	8832.4	185.466	86.84	120.28	.27060E-01	1345	1.91698
220.000	.1126E+02	.65472E+03	.00728	1.175262	1.20861	10029.6	10042.9	191.099	87.88	121.97	.52015E-01	1295	1.90060
230.000	.1110E+02	.64493E+03	.00707	1.098076	1.11404	11258.1	11271.6	196.563	89.14	123.93	.93522E-01	1244	1.88408
240.000	.1092E+02	.63499E+03	.00688	1.025214	1.02345	12507.4	12521.2	201.883	90.59	126.12	.15869E+00	1193	1.86739
250.000	.1075E+02	.62488E+03	.00671	.956225	.93663	13780.0	13794.0	207.080	92.20	128.53	.25602E+00	1142	1.85049
260.000	.1057E+02	.61456E+03	.00656	.890709	.85340	15078.1	15092.3	212.171	93.94	131.14	.39515E+00	1091	1.83333
270.000	.1039E+02	.60399E+03	.00643	.828312	.77362	16403.7	16418.1	217.172	95.79	133.94	.58648E+00	1040	1.81586
280.000	.1020E+02	.59313E+03	.00631	.768712	.69716	17758.7	17773.4	222.097	97.73	136.94	.84071E+00	988	1.79800
283.407	.1014E+02	.58935E+03	.00628	.748991	.67184	18227.2	18242.0	223.758	98.41	138.01	.94363E+00	970	1.79182
283.407	.6726E-01	.39092E+01	.94648	.000593	.03630	37876.4	40106.7	300.907	87.99	98.44	.94363E+00	201	1.00416
290.000	.6546E-01	.38050E+01	.95029	.000573	.03748	38468.0	40759.3	303.183	89.37	99.57	.94704E+00	204	1.00405
300.000	.6295E-01	.36591E+01	.95526	.000547	.03921	39381.9	41764.7	306.592	91.61	101.54	.95156E+00	208	1.00390
310.000	.6065E-01	.35255E+01	.95946	.000524	.04090	40317.6	42790.6	309.955	93.96	103.68	.95549E+00	212	1.00375
320.000	.5854E-01	.34026E+01	.96307	.000503	.04256	41276.2	43838.6	313.282	96.38	105.93	.95895E+00	216	1.00362
330.000	.5658E-01	.32888E+01	.96620	.000484	.04419	42258.4	44909.5	316.578	98.85	108.26	.96201E+00	219	1.00350
340.000	.5476E-01	.31830E+01	.96894	.000467	.04579	43264.8	46003.9	319.845	101.34	110.64	.96474E+00	223	1.00339
350.000	.5307E-01	.30844E+01	.97135	.000452	.04738	44295.7	47122.4	323.087	103.85	113.06	.96718E+00	227	1.00328
360.000	.5148E-01	.29921E+01	.97349	.000437	.04895	45351.3	48265.1	326.306	106.36	115.49	.96938E+00	230	1.00319
370.000	.4999E-01	.29055E+01	.97540	.000424	.05051	46431.5	49432.2	329.503	108.88	117.94	.97134E+00	233	1.00309
380.000	.4859E-01	.28241E+01	.97712	.000411	.05206	47536.7	50624.0	332.681	111.40	120.40	.97315E+00	237	1.00301
390.000	.4727E-01	.27474E+01	.97867	.000400	.05360	48666.8	51840.2	335.841	113.90	122.85	.97479E+00	240	1.00293
400.000	.4602E-01	.26748E+01	.98006	.000389	.05512	49821.5	53081.0	338.982	116.40	125.30	.97629E+00	243	1.00285
410.000	.4484E-01	.26062E+01	.98133	.000378	.05665	51000.9	54346.2	342.106	118.88	127.74	.97767E+00	246	1.00278
420.000	.4372E-01	.25412E+01	.98249	.000369	.05816	52204.8	55635.8	345.213	121.33	130.16	.97893E+00	249	1.00271
430.000	.4266E-01	.24794E+01	.98355	.000359	.05967	53433.0	56949.4	348.304	123.77	132.57	.98010E+00	252	1.00264
440.000	.4165E-01	.24207E+01	.98452	.000351	.06118	54685.3	58287.1	351.379	126.19	134.95	.98117E+00	255	1.00258
450.000	.4068E-01	.23647E+01	.98541	.000342	.06267	55961.5	59648.4	354.438	128.58	137.32	.98216E+00	258	1.00252
460.000	.3977E-01	.23114E+01	.98623	.000334	.06417	57261.3	61033.3	357.482	130.94	139.66	.98308E+00	261	0.00000
470.000	.3889E-01	.22605E+01	.98699	.000327	.06566	58584.6	62441.5	360.511	133.28	141.97	.98394E+00	264	0.00000
480.000	.3805E-01	.22118E+01	.98769	.000320	.06715	59930.9	63872.7	363.524	135.59	144.26	.98474E+00	267	0.00000
490.000	.3725E-01	.21653E+01	.98834	.000313	.06863	61300.1	65326.7	366.521	137.87	146.53	.98548E+00	270	0.00000
500.000	.3648E-01	.21207E+01	.98894	.000306	.07012	62691.9	66803.2	369.504	140.12	148.76	.98617E+00	272	0.00000
520.000	.3504E-01	.20369E+01	.99003	.000294	.07307	65542.0	69822.4	375.425	144.54	153.15	.98743E+00	278	0.00000
540.000	.3371E-01	.19595E+01	.99098	.000283	.07602	68478.9	72928.2	381.285	148.83	157.41	.98853E+00	283	0.00000
560.000	.3248E-01	.18880E+01	.99181	.000272	.07896	71500.2	76118.2	387.085	153.00	161.56	.98951E+00	288	0.00000
580.000	.3134E-01	.18215E+01	.99254	.000262	.08189	74603.5	79389.9	392.825	157.05	165.59	.99037E+00	293	0.00000
620.000	.2928E-01	.17019E+01	.99377	.000245	.08774	81046.7	86169.5	404.126	164.80	173.31	.99184E+00	303	0.00000
660.000	.2748E-01	.15972E+01	.99475	.000230	.09357	87789.8	93248.5	415.188	172.09	180.57	.99302E+00	313	0.00000
700.000	.2589E-01	.15047E+01	.99554	.000216	.09938	94815.1	100609.3	426.013	178.94	187.40	.99399E+00	322	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 0.2 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	Cv J/(mol•K)	Cp J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
134.894	.1265E+02	.73533E+03	.01410	2.110256	2.23661	1.2	17.0	133.553	88.51	117.38	.34376E-05	1722	2.03866
140.000	.1257E+02	.73052E+03	.01367	2.033234	2.15905	600.0	615.9	137.908	87.87	117.07	.87279E-05	1696	2.03038
150.000	.1241E+02	.72111E+03	.01293	1.892993	2.01513	1768.5	1784.6	145.968	86.79	116.61	.44052E-04	1645	2.01418
160.000	.1224E+02	.71172E+03	.01228	1.764995	1.88040	2933.7	2950.0	153.486	86.00	116.41	.17719E-03	1595	1.99801
170.000	.1208E+02	.70233E+03	.01171	1.647492	1.75358	4098.7	4115.2	160.545	85.52	116.53	.59261E-03	1545	1.98185
180.000	.1192E+02	.69293E+03	.01121	1.539064	1.63365	5266.4	5283.2	167.216	85.38	116.97	.17023E-02	1496	1.96570
190.000	.1176E+02	.68349E+03	.01077	1.438548	1.51982	6440.1	6457.1	173.560	85.57	117.76	.43074E-02	1446	1.94954
200.000	.1160E+02	.67399E+03	.01037	1.344973	1.41147	7622.9	7640.2	179.627	86.06	118.86	.97956E-02	1396	1.93332
210.000	.1143E+02	.66442E+03	.01002	1.257526	1.30809	8817.9	8835.4	185.459	86.85	120.27	.20346E-01	1345	1.91704
220.000	.1126E+02	.65476E+03	.00971	1.175512	1.20928	10028.2	10045.9	191.093	87.88	121.97	.39106E-01	1295	1.90066
230.000	.1110E+02	.64497E+03	.00943	1.098337	1.11473	11256.5	11274.6	196.557	89.14	123.92	.70307E-01	1244	1.88415
240.000	.1093E+02	.63504E+03	.00917	1.025486	1.02416	12505.7	12524.0	201.876	90.59	126.11	.11929E+00	1194	1.86747
250.000	.1075E+02	.62494E+03	.00895	.956508	.93735	13778.1	13796.7	207.072	92.20	128.52	.19245E+00	1143	1.85058
260.000	.1057E+02	.61462E+03	.00875	.891006	.85415	15076.0	15094.9	212.163	93.94	131.12	.29701E+00	1091	1.83343
270.000	.1039E+02	.60406E+03	.00857	.828625	.77438	16401.4	16420.6	217.163	95.79	133.93	.44080E+00	1040	1.81596
280.000	.1021E+02	.59320E+03	.00842	.769041	.69794	17756.1	17775.7	222.088	97.73	136.92	.63186E+00	988	1.79812
290.000	.1001E+02	.58200E+03	.00828	.711960	.62472	19142.2	19162.1	226.948	99.75	140.13	.87803E+00	936	1.77981
291.935	.9975E+01	.57979E+03	.00826	.701179	.61091	19414.1	19434.2	227.882	100.15	140.77	.93264E+00	926	1.77621
291.935	.8814E-01	.51229E+01	.93486	.000789	.03640	38554.6	40823.8	301.150	90.47	101.54	.93264E+00	202	1.00546
300.000	.8525E-01	.49554E+01	.94049	.000755	.03792	39301.7	41647.6	303.933	92.11	102.80	.93752E+00	205	1.00528
310.000	.8199E-01	.47655E+01	.94641	.000720	.03974	40245.4	42684.8	307.334	94.34	104.67	.94275E+00	209	1.00508
320.000	.7901E-01	.45922E+01	.95143	.000688	.04149	41210.3	43741.8	310.689	96.67	106.74	.94733E+00	214	1.00489
330.000	.7627E-01	.44330E+01	.95574	.000661	.04321	42197.8	44820.1	314.007	99.08	108.94	.95136E+00	217	1.00472
340.000	.7374E-01	.42858E+01	.95949	.000636	.04488	43208.5	45920.9	317.293	101.53	111.22	.95494E+00	221	1.00457
350.000	.7138E-01	.41492E+01	.96277	.000613	.04654	44243.0	47044.7	320.551	104.01	113.56	.95814E+00	225	1.00442
360.000	.6919E-01	.40218E+01	.96567	.000593	.04816	45301.7	48192.2	323.783	106.50	115.93	.96100E+00	228	1.00428
370.000	.6714E-01	.39027E+01	.96824	.000574	.04977	46384.8	49363.4	326.992	109.00	118.33	.96357E+00	232	1.00416
380.000	.6522E-01	.37910E+01	.97054	.000556	.05136	47492.4	50558.8	330.180	111.50	120.75	.96591E+00	235	1.00404
390.000	.6342E-01	.36860E+01	.97260	.000540	.05294	48624.6	51778.4	333.348	113.99	123.17	.96804E+00	239	1.00393
400.000	.6171E-01	.35870E+01	.97446	.000524	.05451	49781.3	53022.2	336.497	116.47	125.58	.96998E+00	242	1.00382
410.000	.6010E-01	.34935E+01	.97614	.000510	.05606	50962.5	54290.1	339.627	118.94	128.00	.97176E+00	245	1.00372
420.000	.5858E-01	.34049E+01	.97767	.000496	.05761	52168.0	55582.1	342.741	121.39	130.40	.97338E+00	248	1.00363
430.000	.5714E-01	.33210E+01	.97906	.000484	.05915	53397.6	56898.0	345.837	123.82	132.78	.97488E+00	251	1.00354
440.000	.5577E-01	.32413E+01	.98034	.000471	.06068	54651.2	58237.7	348.917	126.23	135.15	.97626E+00	254	1.00345
450.000	.5446E-01	.31655E+01	.98150	.000460	.06220	55928.6	59601.0	351.980	128.62	137.50	.97754E+00	257	1.00337
460.000	.5322E-01	.30933E+01	.98258	.000449	.06372	57229.6	60987.6	355.028	130.98	139.83	.97872E+00	260	0.00000
470.000	.5203E-01	.30245E+01	.98357	.000439	.06523	58553.8	62397.4	358.060	133.32	142.13	.97982E+00	263	0.00000
480.000	.5090E-01	.29587E+01	.98448	.000429	.06674	59901.2	63830.2	361.076	135.62	144.41	.98084E+00	266	0.00000
490.000	.4982E-01	.28958E+01	.98533	.000420	.06825	61271.3	65285.6	364.077	137.90	146.66	.98179E+00	269	0.00000
500.000	.4879E-01	.28357E+01	.98611	.000411	.06974	62663.9	66763.4	367.062	140.15	148.89	.98267E+00	272	0.00000
520.000	.4684E-01	.27227E+01	.98752	.000394	.07273	65515.5	69785.1	372.987	144.56	153.26	.98427E+00	277	0.00000
540.000	.4505E-01	.26186E+01	.98874	.000379	.07571	68453.8	72893.1	378.852	148.85	157.52	.98568E+00	283	0.00000
560.000	.4340E-01	.25224E+01	.98981	.000364	.07867	71476.3	76085.0	384.655	153.02	161.66	.98692E+00	288	0.00000
580.000	.4186E-01	.24331E+01	.99075	.000351	.08163	74580.7	79358.5	390.399	157.07	165.68	.98802E+00	293	0.00000
620.000	.3910E-01	.22725E+01	.99232	.000328	.08752	81025.7	86141.1	401.704	164.81	173.38	.98988E+00	303	0.00000
660.000	.3668E-01	.21321E+01	.99357	.000307	.09338	87770.4	93222.7	412.770	172.10	180.63	.99137E+00	313	0.00000
700.000	.3455E-01	.20082E+01	.99458	.000289	.09922	94797.1	100585.7	423.599	178.95	187.45	.99260E+00	322	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 0.3 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
134.910	.1265E+02	.73536E+03	.02114	2.110340	2.23745	1.8	25.5	133.557	88.51	117.38	.23153E-05	1722	2.03871
140.000	.1257E+02	.73056E+03	.02050	2.033588	2.16016	598.6	622.5	137.898	87.88	117.06	.58585E-05	1696	2.03045
150.000	.1241E+02	.72116E+03	.01939	1.893367	2.01626	1766.9	1791.1	145.957	86.80	116.60	.29559E-04	1645	2.01426
160.000	.1225E+02	.71178E+03	.01842	1.765389	1.88156	2932.0	2956.5	153.475	86.00	116.41	.11886E-03	1595	1.99809
170.000	.1208E+02	.70239E+03	.01756	1.647903	1.75476	4096.8	4121.6	160.534	85.53	116.52	.39739E-03	1546	1.98195
180.000	.1192E+02	.69299E+03	.01681	1.539492	1.63486	5264.4	5289.6	167.205	85.38	116.97	.11412E-02	1496	1.96580
190.000	.1176E+02	.68355E+03	.01615	1.438993	1.52106	6437.9	6463.4	173.549	85.57	117.75	.28871E-02	1446	1.94964
200.000	.1160E+02	.67406E+03	.01556	1.345436	1.41274	7620.5	7646.3	179.615	86.07	118.85	.65644E-02	1396	1.93344
210.000	.1143E+02	.66450E+03	.01503	1.258006	1.30939	8815.3	8841.5	185.447	86.85	120.26	.13632E-01	1346	1.91717
220.000	.1127E+02	.65484E+03	.01456	1.176012	1.21062	10025.3	10051.9	191.079	87.89	121.96	.26197E-01	1296	1.90080
230.000	.1110E+02	.64506E+03	.01414	1.098857	1.11610	11253.4	11280.4	196.543	89.15	123.91	.47093E-01	1245	1.88430
240.000	.1093E+02	.63514E+03	.01376	1.026028	1.02556	12502.3	12529.7	201.862	90.60	126.09	.79895E-01	1194	1.86763
250.000	.1075E+02	.62504E+03	.01342	.957075	.93880	13774.3	13802.2	207.057	92.20	128.50	.12887E+00	1143	1.85075
260.000	.1058E+02	.61474E+03	.01312	.891600	.85563	15071.8	15100.2	212.147	93.94	131.10	.19888E+00	1092	1.83362
270.000	.1039E+02	.60419E+03	.01286	.829248	.77591	16396.8	16425.6	217.146	95.80	133.90	.29513E+00	1041	1.81617
280.000	.1021E+02	.59335E+03	.01262	.769699	.69951	17751.1	17780.4	222.069	97.74	136.89	.42302E+00	989	1.79835
290.000	.1002E+02	.58216E+03	.01242	.712656	.62633	19136.5	19166.5	226.928	99.75	140.08	.58778E+00	937	1.78007
300.000	.9816E+01	.57057E+03	.01225	.657844	.55627	20555.0	20585.6	231.734	101.83	143.50	.79423E+00	885	1.76125
304.979	.9714E+01	.56461E+03	.01218	.631300	.52252	21274.7	21305.6	234.113	102.89	145.30	.91382E+00	859	1.75164
304.979	.1295E+00	.75252E+01	.91380	.001193	.03614	39600.7	41917.8	301.698	94.42	106.75	.91382E+00	202	1.00803
310.000	.1267E+00	.73644E+01	.91864	.001157	.03720	40087.3	42455.1	303.445	95.35	107.30	.91775E+00	204	1.00785
320.000	.1216E+00	.70700E+01	.92699	.001095	.03921	41068.8	43535.2	306.874	97.42	108.79	.92464E+00	209	1.00754
330.000	.1171E+00	.68041E+01	.93402	.001042	.04113	42069.1	44631.9	310.249	99.65	110.60	.93066E+00	213	1.00726
340.000	.1129E+00	.65618E+01	.94003	.000997	.04298	43090.3	45747.7	313.580	101.99	112.60	.93597E+00	217	1.00700
350.000	.1091E+00	.63392E+01	.94523	.000957	.04478	44133.6	46884.3	316.874	104.38	114.73	.94069E+00	221	1.00676
360.000	.1055E+00	.61337E+01	.94977	.000921	.04654	45199.7	48042.6	320.137	106.81	116.94	.94490E+00	225	1.00654
370.000	.1022E+00	.59429E+01	.95377	.000888	.04826	46289.1	49223.3	323.372	109.26	119.21	.94866E+00	229	1.00634
380.000	.9919E-01	.57651E+01	.95732	.000858	.04995	47402.3	50426.9	326.582	111.72	121.52	.95207E+00	233	1.00615
390.000	.9632E-01	.55988E+01	.96048	.000831	.05162	48539.3	51653.8	329.768	114.18	123.86	.95517E+00	236	1.00597
400.000	.9364E-01	.54428E+01	.96331	.000805	.05326	49700.3	52904.1	332.934	116.64	126.20	.95798E+00	240	1.00580
410.000	.9111E-01	.52960E+01	.96586	.000782	.05489	50885.3	54177.9	336.079	119.09	128.55	.96054E+00	243	1.00565
420.000	.8873E-01	.51576E+01	.96816	.000760	.05650	52094.3	55475.2	339.205	121.52	130.90	.96289E+00	246	1.00550
430.000	.8648E-01	.50268E+01	.97025	.000739	.05810	53327.1	56795.9	342.313	123.94	133.24	.96504E+00	249	1.00536
440.000	.8435E-01	.49029E+01	.97215	.000720	.05969	54583.5	58140.0	345.403	126.34	135.57	.96702E+00	253	1.00523
450.000	.8233E-01	.47854E+01	.97389	.000702	.06126	55863.5	59507.4	348.475	128.71	137.89	.96885E+00	256	1.00510
460.000	.8041E-01	.46737E+01	.97548	.000684	.06283	57166.9	60897.8	351.531	131.07	140.19	.97054E+00	259	0.00000
470.000	.7858E-01	.45675E+01	.97695	.000668	.06439	58493.3	62311.1	354.570	133.39	142.46	.97210E+00	262	0.00000
480.000	.7684E-01	.44661E+01	.97829	.000652	.06594	59842.7	63747.0	357.594	135.69	144.72	.97355E+00	265	0.00000
490.000	.7517E-01	.43694E+01	.97954	.000638	.06748	61214.7	65205.4	360.601	137.96	146.95	.97490E+00	268	0.00000
500.000	.7358E-01	.42770E+01	.98068	.000624	.06901	62609.0	66686.0	363.592	140.21	149.16	.97616E+00	270	0.00000
520.000	.7061E-01	.41039E+01	.98274	.000597	.07207	65463.9	69712.8	369.527	144.61	153.50	.97842E+00	276	0.00000
540.000	.6787E-01	.39448E+01	.98451	.000574	.07510	68404.9	72825.2	375.399	148.89	157.73	.98041E+00	282	0.00000
560.000	.6534E-01	.37980E+01	.98606	.000552	.07812	71429.9	76021.1	381.210	153.06	161.84	.98216E+00	287	0.00000
580.000	.6300E-01	.36620E+01	.98741	.000531	.08112	74536.5	79298.2	386.960	157.10	165.85	.98371E+00	292	0.00000
620.000	.5880E-01	.34179E+01	.98966	.000495	.08709	80985.4	86087.1	398.276	164.84	173.52	.98631E+00	302	0.00000
660.000	.5514E-01	.32051E+01	.99143	.000464	.09303	87733.3	93173.8	409.350	172.12	180.75	.98840E+00	312	0.00000
700.000	.5192E-01	.30176E+01	.99285	.000436	.09893	94762.6	100541.1	420.186	178.96	187.55	.99010E+00	321	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 0.4 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
134.927	.1265E+02	.73539E+03	.02818	2.110423	2.23829	2.4	34.0	133.562	88.52	117.37	.17544E-05	1722	2.03875
140.000	.1257E+02	.73061E+03	.02734	2.033943	2.16127	597.2	629.0	137.888	87.88	117.06	.44240E-05	1696	2.03053
150.000	.1241E+02	.72121E+03	.02585	1.893742	2.01739	1765.3	1797.6	145.947	86.80	116.60	.22313E-04	1646	2.01434
160.000	.1225E+02	.71183E+03	.02455	1.765782	1.88272	2930.3	2962.9	153.464	86.01	116.40	.89691E-04	1596	1.99818
170.000	.1209E+02	.70245E+03	.02342	1.648313	1.75595	4094.9	4128.0	160.523	85.53	116.52	.29980E-03	1546	1.98204
180.000	.1192E+02	.69305E+03	.02242	1.539920	1.63607	5262.3	5295.9	167.194	85.39	116.96	.86073E-03	1496	1.96590
190.000	.1176E+02	.68362E+03	.02153	1.439438	1.52230	6435.7	6469.7	173.537	85.58	117.74	.21770E-02	1447	1.94975
200.000	.1160E+02	.67413E+03	.02074	1.345898	1.41401	7618.0	7652.5	179.603	86.07	118.84	.49489E-02	1397	1.93356
210.000	.1143E+02	.66457E+03	.02004	1.258487	1.31069	8812.6	8847.6	185.434	86.86	120.25	.10275E-01	1347	1.91729
220.000	.1127E+02	.65492E+03	.01941	1.176511	1.21195	10022.4	10057.9	191.066	87.90	121.94	.19744E-01	1296	1.90093
230.000	.1110E+02	.64515E+03	.01884	1.099377	1.11747	11250.2	11286.3	196.529	89.15	123.89	.35486E-01	1246	1.88444
240.000	.1093E+02	.63524E+03	.01834	1.026570	1.02697	12498.8	12535.4	201.847	90.60	126.08	.60197E-01	1195	1.86779
250.000	.1076E+02	.62515E+03	.01789	.957641	.94024	13770.5	13807.7	207.042	92.21	128.48	.97089E-01	1144	1.85093
260.000	.1058E+02	.61485E+03	.01749	.892192	.85711	15067.7	15105.5	212.131	93.95	131.08	.14981E+00	1093	1.83381
270.000	.1040E+02	.60432E+03	.01714	.829870	.77743	16392.2	16430.7	217.129	95.80	133.87	.22230E+00	1042	1.81638
280.000	.1021E+02	.59349E+03	.01683	.770355	.70108	17746.0	17785.2	222.051	97.74	136.85	.31860E+00	990	1.79858
290.000	.1002E+02	.58232E+03	.01656	.713351	.62795	19130.9	19170.8	226.909	99.76	140.04	.44267E+00	938	1.78033
300.000	.9819E+01	.57075E+03	.01633	.658584	.55794	20548.7	20589.4	231.713	101.84	143.45	.59811E+00	886	1.76154
310.000	.9612E+01	.55868E+03	.01615	.605786	.49096	22001.7	22043.3	236.476	103.97	147.12	.78801E+00	833	1.74209
315.047	.9503E+01	.55238E+03	.01607	.579803	.45828	22749.5	22791.6	238.869	105.05	149.08	.89765E+00	806	1.73198
315.047	.1707E+00	.99213E+01	.89462	.001615	.03557	40411.6	42755.0	302.236	97.60	111.25	.89765E+00	201	1.01059
320.000	.1669E+00	.97037E+01	.90052	.001562	.03671	40910.8	43306.8	303.973	98.44	111.57	.90221E+00	203	1.01036
330.000	.1601E+00	.93030E+01	.91085	.001471	.03890	41928.6	44427.8	307.422	100.40	112.73	.91032E+00	208	1.00993
340.000	.1539E+00	.89442E+01	.91952	.001395	.04096	42963.3	45562.7	310.810	102.56	114.31	.91743E+00	213	1.00955
350.000	.1483E+00	.86194E+01	.92691	.001331	.04293	44017.4	46714.8	314.149	104.84	116.14	.92370E+00	218	1.00920
360.000	.1432E+00	.83225E+01	.93331	.001275	.04483	45092.5	47886.0	317.449	107.18	118.13	.92928E+00	222	1.00888
370.000	.1385E+00	.80495E+01	.93888	.001225	.04668	46189.4	49077.7	320.714	109.57	120.24	.93425E+00	226	1.00859
380.000	.1341E+00	.77969E+01	.94379	.001180	.04848	47309.0	50290.9	323.949	111.98	122.41	.93874E+00	230	1.00832
390.000	.1301E+00	.75621E+01	.94814	.001139	.05025	48451.6	51526.1	327.158	114.41	124.64	.94280E+00	233	1.00807
400.000	.1263E+00	.73430E+01	.95202	.001101	.05198	49617.5	52783.8	330.341	116.84	126.89	.94647E+00	237	1.00784
410.000	.1228E+00	.71379E+01	.95549	.001067	.05369	50806.9	54064.1	333.503	119.26	129.17	.94982E+00	241	1.00762
420.000	.1195E+00	.69452E+01	.95862	.001035	.05538	52019.7	55367.2	336.643	121.67	131.46	.95288E+00	244	1.00741
430.000	.1164E+00	.67638E+01	.96144	.001005	.05704	53255.9	56693.3	339.763	124.07	133.75	.95568E+00	247	1.00722
440.000	.1134E+00	.65925E+01	.96400	.000977	.05869	54515.5	58042.2	342.864	126.45	136.03	.95825E+00	251	1.00703
450.000	.1106E+00	.64304E+01	.96634	.000951	.06032	55798.3	59413.9	345.946	128.82	138.31	.96062E+00	254	1.00686
460.000	.1080E+00	.62768E+01	.96847	.000927	.06193	57104.2	60808.3	349.011	131.16	140.57	.96280E+00	257	0.00000
470.000	.1055E+00	.61309E+01	.97042	.000904	.06354	58433.1	62225.3	352.058	133.48	142.82	.96483E+00	260	0.00000
480.000	.1031E+00	.59921E+01	.97221	.000882	.06513	59784.6	63664.7	355.089	135.77	145.05	.96670E+00	263	0.00000
490.000	.1008E+00	.58599E+01	.97386	.000861	.06671	61158.6	65126.2	358.102	138.03	147.26	.96844E+00	266	0.00000
500.000	.9865E-01	.57337E+01	.97539	.000842	.06829	62554.8	66609.8	361.099	140.27	149.44	.97006E+00	269	0.00000
520.000	.9459E-01	.54979E+01	.97810	.000805	.07141	65413.0	69641.8	367.045	144.66	153.75	.97297E+00	275	0.00000
540.000	.9087E-01	.52817E+01	.98043	.000772	.07451	68357.0	72759.0	372.926	148.94	157.95	.97552E+00	281	0.00000
560.000	.8744E-01	.50825E+01	.98246	.000742	.07758	71384.5	75959.0	378.745	153.10	162.04	.97776E+00	286	0.00000
580.000	.8428E-01	.48984E+01	.98423	.000714	.08063	74493.5	79239.8	384.501	157.14	166.02	.97974E+00	291	0.00000
620.000	.7860E-01	.45688E+01	.98715	.000665	.08669	80946.3	86035.0	395.827	164.86	173.66	.98305E+00	302	0.00000
660.000	.7367E-01	.42820E+01	.98944	.000622	.09269	87697.4	93127.0	406.910	172.14	180.87	.98571E+00	312	0.00000
700.000	.6933E-01	.40299E+01	.99127	.000584	.09865	94729.4	100498.7	417.752	178.98	187.65	.98786E+00	321	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 0.5 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	Cv J/(mol•K)	Cp J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
134.944	.1265E+02	.73542E+03	.03522	2.110507	2.23913	3.0	42.5	133.566	88.52	117.37	.14179E-05	1723	2.03880
140.000	.1257E+02	.73066E+03	.03417	2.034297	2.16238	595.7	635.5	137.877	87.89	117.06	.35635E-05	1697	2.03060
150.000	.1241E+02	.72126E+03	.03231	1.894117	2.01853	1763.8	1804.1	145.936	86.81	116.60	.17966E-04	1646	2.01442
160.000	.1225E+02	.71188E+03	.03069	1.766175	1.88388	2928.5	2969.4	153.453	86.01	116.40	.72194E-04	1596	1.99826
170.000	.1209E+02	.70251E+03	.02927	1.648724	1.75713	4093.0	4134.4	160.512	85.54	116.51	.24124E-03	1547	1.98213
180.000	.1192E+02	.69311E+03	.02802	1.540348	1.63728	5260.3	5302.2	167.182	85.39	116.95	.69246E-03	1497	1.96600
190.000	.1176E+02	.68368E+03	.02691	1.439883	1.52354	6433.4	6475.9	173.525	85.58	117.73	.17510E-02	1447	1.94986
200.000	.1160E+02	.67420E+03	.02592	1.346360	1.41528	7615.6	7658.7	179.591	86.08	118.84	.39797E-02	1397	1.93367
210.000	.1143E+02	.66465E+03	.02504	1.258967	1.31200	8810.0	8853.7	185.421	86.86	120.24	.82616E-02	1347	1.91742
220.000	.1127E+02	.65500E+03	.02426	1.177010	1.21329	10019.5	10063.9	191.053	87.90	121.93	.15872E-01	1297	1.90107
230.000	.1110E+02	.64524E+03	.02355	1.099896	1.11883	11247.1	11292.1	196.515	89.16	123.88	.28523E-01	1246	1.88459
240.000	.1093E+02	.63533E+03	.02292	1.027111	1.02837	12495.4	12541.1	201.833	90.61	126.06	.48379E-01	1196	1.86795
250.000	.1076E+02	.62525E+03	.02236	.958206	.94168	13766.8	13813.2	207.027	92.21	128.46	.78019E-01	1145	1.85110
260.000	.1058E+02	.61497E+03	.02186	.892784	.85859	15063.5	15110.8	212.115	93.96	131.05	.12037E+00	1094	1.83399
270.000	.1040E+02	.60444E+03	.02142	.830492	.77895	16387.6	16435.7	217.112	95.81	133.84	.17860E+00	1043	1.81659
280.000	.1021E+02	.59363E+03	.02103	.771010	.70265	17740.9	17789.9	222.033	97.75	136.82	.25596E+00	991	1.79881
290.000	.1002E+02	.58248E+03	.02069	.714045	.62956	19125.2	19175.1	226.889	99.76	140.00	.35560E+00	939	1.78058
300.000	.9822E+01	.57092E+03	.02041	.659323	.55960	20542.4	20593.3	231.692	101.84	143.40	.48045E+00	887	1.76182
310.000	.9615E+01	.55889E+03	.02017	.606577	.49268	21994.6	22046.6	236.453	103.97	147.05	.63296E+00	834	1.74241
320.000	.9398E+01	.54626E+03	.02000	.555542	.42870	23484.2	23537.4	241.183	106.13	151.00	.81501E+00	780	1.72221
323.372	.9322E+01	.54185E+03	.01995	.538671	.40777	23995.9	24049.5	242.775	106.86	152.42	.88325E+00	762	1.71519
323.372	.2121E+00	.12329E+02	.87670	.002057	.03483	41082.0	43439.2	302.736	100.34	115.37	.88325E+00	200	1.01318
330.000	.2057E+00	.11956E+02	.88591	.001960	.03648	41773.4	44204.1	305.076	101.38	115.52	.89005E+00	203	1.01278
340.000	.1970E+00	.11452E+02	.89773	.001841	.03880	42825.6	45363.4	308.537	103.28	116.44	.89905E+00	209	1.01224
350.000	.1893E+00	.11003E+02	.90766	.001743	.04098	43893.1	46534.5	311.931	105.39	117.84	.90693E+00	214	1.01175
360.000	.1823E+00	.10598E+02	.91614	.001659	.04305	44979.0	47721.2	315.274	107.62	119.53	.91391E+00	218	1.01132
370.000	.1760E+00	.10230E+02	.92347	.001586	.04505	46084.8	48925.7	318.574	109.93	121.41	.92011E+00	223	1.01093
380.000	.1702E+00	.98921E+01	.92987	.001522	.04697	47211.9	50149.8	321.839	112.28	123.42	.92569E+00	227	1.01057
390.000	.1648E+00	.95804E+01	.93550	.001465	.04885	48360.9	51394.4	325.072	114.66	125.51	.93072E+00	231	1.01023
400.000	.1599E+00	.92913E+01	.94050	.001413	.05068	49532.3	52660.2	328.276	117.05	127.66	.93527E+00	235	1.00992
410.000	.1552E+00	.90219E+01	.94495	.001366	.05247	50726.5	53947.7	331.455	119.44	129.85	.93941E+00	238	1.00963
420.000	.1509E+00	.87700E+01	.94895	.001322	.05423	51943.5	55257.3	334.611	121.83	132.06	.94318E+00	242	1.00936
430.000	.1468E+00	.85337E+01	.95254	.001282	.05596	53183.5	56589.1	337.745	124.21	134.29	.94662E+00	245	1.00911
440.000	.1430E+00	.83114E+01	.95580	.001245	.05767	54446.5	57943.2	340.857	126.58	136.53	.94978E+00	249	1.00887
450.000	.1394E+00	.81016E+01	.95875	.001210	.05936	55732.4	59319.6	343.951	128.93	138.76	.95269E+00	252	1.00865
460.000	.1360E+00	.79033E+01	.96144	.001177	.06103	57041.1	60718.3	347.025	131.26	140.98	.95536E+00	256	0.00000
470.000	.1327E+00	.77155E+01	.96390	.001147	.06268	58372.5	62139.2	350.080	133.57	143.20	.95784E+00	259	0.00000
480.000	.1297E+00	.75371E+01	.96615	.001118	.06432	59726.4	63582.2	353.118	135.85	145.40	.96013E+00	262	0.00000
490.000	.1268E+00	.73675E+01	.96822	.001091	.06594	61102.5	65047.1	356.139	138.11	147.58	.96225E+00	265	0.00000
500.000	.1240E+00	.72060E+01	.97013	.001065	.06756	62500.7	66533.8	359.142	140.34	149.74	.96423E+00	268	0.00000
520.000	.1188E+00	.69047E+01	.97351	.001018	.07075	65362.4	69571.4	365.098	144.72	154.01	.96778E+00	274	0.00000
540.000	.1141E+00	.66292E+01	.97642	.000975	.07391	68309.4	72693.4	370.989	148.99	158.17	.97088E+00	280	0.00000
560.000	.1097E+00	.63760E+01	.97893	.000936	.07704	71339.7	75897.7	376.815	153.14	162.24	.97360E+00	285	0.00000
580.000	.1057E+00	.61424E+01	.98112	.000900	.08014	74451.0	79182.3	382.578	157.17	166.20	.97600E+00	291	0.00000
620.000	.9850E-01	.57251E+01	.98472	.000836	.08628	80907.8	85984.0	393.916	164.89	173.81	.98001E+00	301	0.00000
660.000	.9226E-01	.53628E+01	.98754	.000782	.09236	87662.2	93081.4	405.006	172.16	180.99	.98322E+00	311	0.00000
700.000	.8680E-01	.50450E+01	.98977	.000734	.09838	94697.0	100457.6	415.855	179.00	187.76	.98581E+00	321	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 0.6 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
134.961	.1265E+02	.73545E+03	.04226	2.110591	2.23997	3.6	51.0	133.571	88.52	117.37	.11938E-05	1723	2.03884
140.000	.1257E+02	.73070E+03	.04100	2.034652	2.16349	594.3	642.0	137.867	87.89	117.05	.29899E-05	1697	2.03068
150.000	.1241E+02	.72131E+03	.03877	1.894491	2.01966	1762.2	1810.5	145.926	86.81	116.59	.15069E-04	1646	2.01450
160.000	.1225E+02	.71194E+03	.03682	1.766568	1.88503	2926.8	2975.8	153.443	86.02	116.39	.60532E-04	1597	1.99835
170.000	.1209E+02	.70256E+03	.03512	1.649134	1.75832	4091.2	4140.8	160.501	85.54	116.50	.20222E-03	1547	1.98223
180.000	.1193E+02	.69317E+03	.03362	1.540775	1.63850	5258.3	5308.6	167.171	85.40	116.95	.58029E-03	1497	1.96610
190.000	.1176E+02	.68375E+03	.03229	1.440327	1.52478	6431.2	6482.2	173.513	85.59	117.73	.14671E-02	1448	1.94996
200.000	.1160E+02	.67427E+03	.03110	1.346822	1.41655	7613.2	7664.9	179.578	86.08	118.83	.33336E-02	1398	1.93379
210.000	.1144E+02	.66473E+03	.03005	1.259447	1.31330	8807.3	8859.8	185.409	86.87	120.23	.69192E-02	1348	1.91754
220.000	.1127E+02	.65509E+03	.02910	1.177509	1.21462	10016.6	10069.8	191.040	87.91	121.92	.13291E-01	1297	1.90120
230.000	.1110E+02	.64533E+03	.02826	1.100415	1.12020	11243.9	11298.0	196.502	89.16	123.86	.23882E-01	1247	1.88474
240.000	.1093E+02	.63543E+03	.02750	1.027652	1.02977	12491.9	12546.8	201.818	90.61	126.04	.40501E-01	1196	1.86811
250.000	.1076E+02	.62536E+03	.02683	.958770	.94312	13763.0	13818.8	207.012	92.22	128.44	.65308E-01	1146	1.85127
260.000	.1058E+02	.61509E+03	.02623	.893375	.86007	15059.4	15116.1	212.099	93.96	131.03	.10075E+00	1095	1.83418
270.000	.1040E+02	.60457E+03	.02570	.831113	.78047	16383.1	16440.7	217.095	95.81	133.81	.14947E+00	1044	1.81679
280.000	.1022E+02	.59377E+03	.02523	.771664	.70421	17735.9	17794.6	222.015	97.75	136.78	.21420E+00	992	1.79903
290.000	.1002E+02	.58264E+03	.02482	.714738	.63117	19119.6	19179.5	226.870	99.77	139.96	.29756E+00	940	1.78084
300.000	.9826E+01	.57110E+03	.02448	.660059	.56127	20536.1	20597.2	231.671	101.85	143.35	.40201E+00	888	1.76211
310.000	.9619E+01	.55909E+03	.02420	.607366	.49440	21987.5	22049.9	236.430	103.98	146.99	.52960E+00	836	1.74274
320.000	.9402E+01	.54649E+03	.02398	.556394	.43048	23476.2	23540.0	241.158	106.14	150.92	.68190E+00	782	1.72258
330.000	.9173E+01	.53319E+03	.02384	.506864	.36941	25005.3	25070.7	245.867	108.31	155.23	.85988E+00	727	1.70145
330.536	.9161E+01	.53245E+03	.02383	.504242	.36621	25088.9	25154.4	246.120	108.43	155.48	.87020E+00	724	1.70029
330.536	.2539E+00	.14760E+02	.85975	.002521	.03399	41657.1	44019.9	303.195	102.76	119.26	.87020E+00	198	1.01579
340.000	.2427E+00	.14107E+02	.87447	.002345	.03650	42675.0	45147.1	306.556	104.17	119.13	.88067E+00	204	1.01509
350.000	.2324E+00	.13506E+02	.88735	.002199	.03893	43759.5	46341.7	310.019	106.05	119.90	.89023E+00	209	1.01444
360.000	.2232E+00	.12972E+02	.89819	.002079	.04120	44858.4	47546.8	313.414	108.14	121.18	.89865E+00	214	1.01387
370.000	.2149E+00	.12492E+02	.90746	.001977	.04335	45974.7	48766.3	316.755	110.34	122.77	.90611E+00	219	1.01336
380.000	.2074E+00	.12057E+02	.91549	.001889	.04542	47110.4	50002.9	320.053	112.62	124.56	.91280E+00	224	1.01289
390.000	.2006E+00	.11658E+02	.92252	.001812	.04741	48266.6	51258.0	323.313	114.94	126.49	.91881E+00	228	1.01246
400.000	.1943E+00	.11291E+02	.92871	.001742	.04934	49444.3	52533.0	326.541	117.29	128.51	.92424E+00	232	1.01207
410.000	.1884E+00	.10951E+02	.93421	.001680	.05122	50643.8	53828.4	329.740	119.65	130.59	.92916E+00	236	1.01170
420.000	.1830E+00	.10634E+02	.93912	.001623	.05306	51865.5	55145.0	332.912	122.01	132.72	.93365E+00	240	1.01136
430.000	.1779E+00	.10338E+02	.94353	.001571	.05487	53109.7	56483.0	336.060	124.37	134.88	.93774E+00	243	1.01105
440.000	.1731E+00	.10061E+02	.94750	.001522	.05664	54376.4	57842.7	339.186	126.72	137.05	.94149E+00	247	1.01075
450.000	.1686E+00	.98002E+01	.95110	.001478	.05839	55665.6	59224.1	342.291	129.05	139.24	.94493E+00	250	1.01047
460.000	.1644E+00	.95543E+01	.95437	.001436	.06012	56977.3	60627.4	345.375	131.37	141.42	.94810E+00	254	0.00000
470.000	.1604E+00	.93219E+01	.95735	.001398	.06182	58311.3	62052.5	348.439	133.66	143.59	.95102E+00	257	0.00000
480.000	.1566E+00	.91018E+01	.96007	.001361	.06351	59667.7	63499.3	351.485	135.94	145.76	.95373E+00	260	0.00000
490.000	.1530E+00	.88929E+01	.96257	.001327	.06517	61046.1	64967.7	354.513	138.19	147.92	.95623E+00	264	0.00000
500.000	.1496E+00	.86943E+01	.96487	.001295	.06683	62446.4	66457.6	357.523	140.41	150.05	.95856E+00	267	0.00000
520.000	.1432E+00	.83247E+01	.96894	.001235	.07009	65311.7	69501.0	363.491	144.78	154.28	.96275E+00	273	0.00000
540.000	.1374E+00	.79877E+01	.97243	.001182	.07332	68262.0	72628.0	369.391	149.04	158.41	.96639E+00	279	0.00000
560.000	.1321E+00	.76786E+01	.97544	.001133	.07650	71295.0	75836.8	375.225	153.18	162.45	.96958E+00	284	0.00000
580.000	.1272E+00	.73940E+01	.97805	.001089	.07966	74408.7	79125.3	380.995	157.21	166.39	.97240E+00	290	0.00000
620.000	.1185E+00	.68868E+01	.98234	.001011	.08588	80869.7	85933.7	392.343	164.92	173.96	.97710E+00	300	0.00000
660.000	.1109E+00	.64475E+01	.98568	.000944	.09203	87627.5	93036.5	403.443	172.18	181.11	.98084E+00	311	0.00000
700.000	.1043E+00	.60628E+01	.98833	.000885	.09811	94665.0	100417.2	414.298	179.02	187.86	.98386E+00	320	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 0.7 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
134.977	.1265E+02	.73547E+03	.04929	2.110675	2.24080	4.2	59.6	133.575	88.53	117.36	.10337E-05	1723	2.03889
140.000	.1257E+02	.73075E+03	.04783	2.035006	2.16460	592.9	648.6	137.857	87.90	117.05	.25804E-05	1697	2.03075
150.000	.1241E+02	.72136E+03	.04522	1.894865	2.02079	1760.6	1817.0	145.916	86.82	116.59	.13000E-04	1647	2.01458
160.000	.1225E+02	.71199E+03	.04296	1.766960	1.88619	2925.1	2982.3	153.432	86.02	116.39	.52204E-04	1597	1.99844
170.000	.1209E+02	.70262E+03	.04097	1.649544	1.75950	4089.3	4147.2	160.490	85.55	116.50	.17435E-03	1547	1.98232
180.000	.1193E+02	.69323E+03	.03922	1.541202	1.63971	5256.2	5314.9	167.160	85.40	116.94	.50019E-03	1498	1.96620
190.000	.1176E+02	.68381E+03	.03766	1.440772	1.52602	6429.0	6488.5	173.502	85.59	117.72	.12643E-02	1448	1.95007
200.000	.1160E+02	.67434E+03	.03628	1.347284	1.41782	7610.8	7671.1	179.566	86.09	118.82	.28722E-02	1398	1.93390
210.000	.1144E+02	.66480E+03	.03505	1.259926	1.31460	8804.7	8865.9	185.396	86.87	120.22	.59605E-02	1348	1.91767
220.000	.1127E+02	.65517E+03	.03395	1.178007	1.21596	10013.7	10075.8	191.027	87.91	121.91	.11447E-01	1298	1.90134
230.000	.1110E+02	.64542E+03	.03296	1.100933	1.12157	11240.8	11303.8	196.488	89.17	123.85	.20567E-01	1248	1.88488
240.000	.1093E+02	.63553E+03	.03208	1.028192	1.03118	12488.5	12552.5	201.804	90.62	126.03	.34874E-01	1197	1.86826
250.000	.1076E+02	.62547E+03	.03130	.959334	.94456	13759.2	13824.3	206.996	92.23	128.42	.56229E-01	1146	1.85144
260.000	.1058E+02	.61520E+03	.03059	.893965	.86155	15055.2	15121.4	212.083	93.97	131.00	.86736E-01	1095	1.83437
270.000	.1040E+02	.60470E+03	.02997	.831732	.78199	16378.5	16445.8	217.078	95.82	133.78	.12867E+00	1044	1.81700
280.000	.1022E+02	.59392E+03	.02943	.772317	.70577	17730.8	17799.3	221.997	97.76	136.75	.18437E+00	993	1.79926
290.000	.1003E+02	.58280E+03	.02895	.715429	.63278	19114.0	19183.8	226.850	99.77	139.92	.25611E+00	942	1.78109
300.000	.9829E+01	.57128E+03	.02855	.660794	.56293	20529.9	20601.1	231.650	101.85	143.30	.34599E+00	889	1.76239
310.000	.9622E+01	.55929E+03	.02822	.608153	.49612	21980.4	22053.2	236.407	103.98	146.92	.45577E+00	837	1.74306
320.000	.9406E+01	.54673E+03	.02797	.557242	.43226	23468.1	23542.6	241.133	106.14	150.84	.58682E+00	783	1.72295
330.000	.9178E+01	.53346E+03	.02780	.507789	.37126	24996.1	25072.4	245.839	108.31	155.13	.73997E+00	729	1.70188
336.865	.9013E+01	.52385E+03	.02773	.474523	.33097	26070.6	26148.3	249.065	109.80	158.35	.85816E+00	690	1.68673
336.865	.2963E+00	.17220E+02	.84357	.003008	.03310	42162.2	44525.0	303.617	104.97	123.03	.85816E+00	196	1.01844
340.000	.2915E+00	.16943E+02	.84946	.002926	.03402	42508.6	44910.0	304.753	105.32	122.65	.86221E+00	199	1.01814
350.000	.2778E+00	.16148E+02	.86583	.002711	.03676	43614.8	46134.4	308.303	106.85	122.44	.87352E+00	205	1.01729
360.000	.2659E+00	.15458E+02	.87937	.002541	.03926	44729.7	47361.8	311.760	108.73	123.14	.88343E+00	210	1.01654
370.000	.2554E+00	.14847E+02	.89082	.002402	.04160	45858.4	48598.8	315.150	110.81	124.34	.89218E+00	216	1.01589
380.000	.2460E+00	.14298E+02	.90064	.002284	.04381	47004.0	49849.6	318.485	113.00	125.86	.90000E+00	220	1.01530
390.000	.2374E+00	.13801E+02	.90917	.002181	.04593	48168.6	51116.7	321.776	115.25	127.58	.90701E+00	225	1.01476
400.000	.2296E+00	.13346E+02	.91665	.002091	.04798	49353.1	52401.7	325.030	117.55	129.45	.91333E+00	229	1.01428
410.000	.2224E+00	.12928E+02	.92325	.002010	.04996	50558.6	53705.9	328.250	119.87	131.41	.91905E+00	234	1.01383
420.000	.2157E+00	.12540E+02	.92913	.001938	.05188	51785.5	55030.1	331.441	122.20	133.44	.92424E+00	238	1.01341
430.000	.2095E+00	.12179E+02	.93439	.001872	.05377	53034.2	56374.8	334.605	124.54	135.51	.92898E+00	241	1.01302
440.000	.2037E+00	.11843E+02	.93911	.001811	.05561	54304.8	57740.5	337.745	126.86	137.62	.93332E+00	245	1.01266
450.000	.1983E+00	.11527E+02	.94338	.001756	.05742	55597.6	59127.3	340.861	129.18	139.74	.93730E+00	249	1.01232
460.000	.1932E+00	.11231E+02	.94724	.001704	.05920	56912.5	60535.4	343.956	131.48	141.88	.94096E+00	252	0.00000
470.000	.1884E+00	.10951E+02	.95076	.001656	.06096	58249.5	61964.9	347.030	133.76	144.01	.94433E+00	256	0.00000
480.000	.1839E+00	.10687E+02	.95397	.001611	.06269	59608.4	63415.7	350.084	136.03	146.15	.94745E+00	259	0.00000
490.000	.1796E+00	.10436E+02	.95691	.001569	.06440	60989.2	64887.7	353.120	138.27	148.27	.95034E+00	262	0.00000
500.000	.1755E+00	.10199E+02	.95961	.001530	.06610	62391.7	66381.0	356.136	140.49	150.38	.95302E+00	265	0.00000
520.000	.1679E+00	.97581E+01	.96438	.001458	.06944	65260.9	69430.5	362.116	144.84	154.55	.95783E+00	272	0.00000
540.000	.1610E+00	.93572E+01	.96846	.001393	.07273	68214.4	72562.7	368.026	149.09	158.65	.96202E+00	278	0.00000
560.000	.1547E+00	.89904E+01	.97197	.001334	.07597	71250.4	75776.0	373.868	153.23	162.66	.96568E+00	283	0.00000
580.000	.1489E+00	.86533E+01	.97501	.001281	.07917	74366.7	79068.6	379.645	157.25	166.58	.96890E+00	289	0.00000
620.000	.1386E+00	.80539E+01	.98000	.001187	.08549	80831.9	85883.7	391.005	164.95	174.11	.97428E+00	300	0.00000
660.000	.1297E+00	.75360E+01	.98386	.001107	.09171	87593.0	92992.1	402.113	172.21	181.24	.97858E+00	310	0.00000
700.000	.1219E+00	.70834E+01	.98691	.001038	.09785	94633.5	100377.4	412.975	179.04	187.97	.98203E+00	320	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 0.8 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
134.994	.1265E+02	.73550E+03	.05633	2.110760	2.24164	4.8	68.1	133.579	88.53	117.36	.91381E-06	1723	2.03893
140.000	.1257E+02	.73079E+03	.05466	2.035360	2.16570	591.4	655.1	137.847	87.90	117.05	.22733E-05	1698	2.03082
150.000	.1241E+02	.72141E+03	.05168	1.895239	2.02193	1759.1	1823.5	145.905	86.82	116.58	.11448E-04	1647	2.01466
160.000	.1225E+02	.71204E+03	.04909	1.767353	1.88735	2923.4	2988.7	153.421	86.03	116.38	.45960E-04	1597	1.99852
170.000	.1209E+02	.70268E+03	.04682	1.649955	1.76068	4087.4	4153.6	160.479	85.55	116.49	.15345E-03	1548	1.98241
180.000	.1193E+02	.69329E+03	.04481	1.541630	1.64092	5254.2	5321.2	167.148	85.41	116.94	.44012E-03	1498	1.96630
190.000	.1177E+02	.68388E+03	.04304	1.441216	1.52726	6426.8	6494.8	173.490	85.60	117.71	.11122E-02	1449	1.95018
200.000	.1160E+02	.67442E+03	.04146	1.347745	1.41909	7608.3	7677.3	179.554	86.09	118.81	.25263E-02	1399	1.93402
210.000	.1144E+02	.66488E+03	.04005	1.260405	1.31590	8802.0	8872.0	185.384	86.88	120.21	.52416E-02	1349	1.91779
220.000	.1127E+02	.65525E+03	.03880	1.178505	1.21729	10010.8	10081.8	191.014	87.92	121.90	.10065E-01	1299	1.90147
230.000	.1111E+02	.64551E+03	.03767	1.101451	1.12294	11237.6	11309.7	196.474	89.17	123.84	.18081E-01	1248	1.88503
240.000	.1094E+02	.63562E+03	.03666	1.028732	1.03258	12485.0	12558.2	201.790	90.62	126.01	.30655E-01	1198	1.86842
250.000	.1076E+02	.62557E+03	.03576	.959898	.94600	13755.5	13829.8	206.981	92.23	128.40	.49421E-01	1147	1.85161
260.000	.1059E+02	.61532E+03	.03496	.894555	.86302	15051.1	15126.7	212.067	93.97	130.98	.76226E-01	1096	1.83456
270.000	.1041E+02	.60483E+03	.03425	.832351	.78351	16374.0	16450.8	217.062	95.82	133.75	.11307E+00	1045	1.81720
280.000	.1022E+02	.59406E+03	.03362	.772969	.70733	17725.8	17804.1	221.979	97.76	136.72	.16200E+00	994	1.79949
290.000	.1003E+02	.58295E+03	.03308	.716118	.63439	19108.4	19188.2	226.831	99.78	139.88	.22503E+00	943	1.78134
300.000	.9832E+01	.57146E+03	.03262	.661528	.56458	20523.6	20605.0	231.629	101.86	143.25	.30398E+00	891	1.76267
310.000	.9626E+01	.55949E+03	.03224	.608937	.49783	21973.4	22056.5	236.384	103.98	146.86	.40041E+00	838	1.74338
320.000	.9410E+01	.54696E+03	.03195	.558089	.43404	23460.2	23545.2	241.108	106.14	150.76	.51552E+00	785	1.72331
330.000	.9182E+01	.53373E+03	.03175	.508711	.37310	24986.9	25074.1	245.811	108.32	155.02	.65005E+00	730	1.70230
340.000	.8940E+01	.51962E+03	.03166	.460498	.31492	26557.8	26647.3	250.508	110.48	159.77	.80425E+00	674	1.68008
342.559	.8875E+01	.51584E+03	.03165	.448304	.30045	26967.5	27057.6	251.709	111.03	161.08	.84697E+00	660	1.67417
342.559	.3392E+00	.19717E+02	.82802	.003520	.03216	42613.3	44971.7	304.004	107.01	126.74	.84697E+00	195	1.02114
350.000	.3261E+00	.18957E+02	.84291	.003292	.03445	43457.0	45909.9	306.712	107.83	125.63	.85675E+00	200	1.02032
360.000	.3109E+00	.18072E+02	.85959	.003054	.03723	44591.7	47164.6	310.247	109.44	125.49	.86824E+00	206	1.01936
370.000	.2977E+00	.17304E+02	.87348	.002865	.03978	45735.2	48422.3	313.693	111.34	126.17	.87831E+00	212	1.01854
380.000	.2860E+00	.16625E+02	.88528	.002709	.04216	46892.4	49689.5	317.072	113.42	127.33	.88728E+00	217	1.01780
390.000	.2755E+00	.16014E+02	.89544	.002576	.04443	48066.3	50969.9	320.398	115.60	128.80	.89530E+00	222	1.01715
400.000	.2660E+00	.15461E+02	.90429	.002461	.04659	49258.7	52266.2	323.680	117.84	130.48	.90252E+00	227	1.01655
410.000	.2573E+00	.14955E+02	.91208	.002359	.04867	50470.7	53580.0	326.924	120.11	132.29	.90904E+00	231	1.01601
420.000	.2493E+00	.14490E+02	.91897	.002268	.05069	51703.3	54912.4	330.134	122.41	134.21	.91496E+00	235	1.01551
430.000	.2419E+00	.14059E+02	.92511	.002186	.05265	52956.9	56264.4	333.316	124.71	136.19	.92035E+00	239	1.01504
440.000	.2350E+00	.13658E+02	.93062	.002112	.05457	54231.8	57636.4	336.470	127.02	138.22	.92528E+00	243	1.01461
450.000	.2285E+00	.13284E+02	.93558	.002044	.05644	55528.4	59028.9	339.599	129.32	140.28	.92979E+00	247	1.01421
460.000	.2225E+00	.12933E+02	.94006	.001981	.05828	56846.7	60442.1	342.705	131.60	142.36	.93394E+00	251	0.00000
470.000	.2168E+00	.12603E+02	.94414	.001923	.06009	58186.7	61876.2	345.789	133.87	144.45	.93777E+00	254	0.00000
480.000	.2115E+00	.12292E+02	.94784	.001869	.06187	59548.4	63331.2	348.852	136.12	146.55	.94130E+00	258	0.00000
490.000	.2064E+00	.11999E+02	.95123	.001818	.06363	60931.7	64807.2	351.896	138.36	148.64	.94456E+00	261	0.00000
500.000	.2016E+00	.11720E+02	.95434	.001771	.06537	62336.5	66303.9	354.919	140.56	150.72	.94759E+00	264	0.00000
520.000	.1928E+00	.11205E+02	.95983	.001685	.06878	65209.8	69359.6	360.911	144.91	154.84	.95303E+00	271	0.00000
540.000	.1847E+00	.10738E+02	.96450	.001608	.07214	68166.8	72497.2	366.831	149.14	158.90	.95775E+00	277	0.00000
560.000	.1774E+00	.10311E+02	.96852	.001539	.07544	71205.7	75715.2	372.682	153.27	162.88	.96188E+00	283	0.00000
580.000	.1707E+00	.99202E+01	.97199	.001476	.07869	74324.6	79011.9	378.466	157.29	166.77	.96551E+00	288	0.00000
620.000	.1587E+00	.92263E+01	.97767	.001366	.08510	80794.1	85834.0	389.838	164.98	174.27	.97156E+00	299	0.00000
660.000	.1484E+00	.86283E+01	.98207	.001273	.09139	87558.8	92948.0	400.955	172.23	181.37	.97639E+00	310	0.00000
700.000	.1395E+00	.81067E+01	.98553	.001192	.09759	94602.1	100338.1	411.823	179.06	188.07	.98025E+00	320	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 1.0 MPa

Temp. K	Density mol/L	Density kg/m^3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m^3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
135.028	.1265E+02	.73556E+03	.07038	2.110929	2.24332	6.1	85.1	133.588	88.54	117.35	.74614E-06	1724	2.03902
140.000	.1257E+02	.73089E+03	.06832	2.036069	2.16792	588.6	668.1	137.826	87.91	117.04	.18437E-05	1698	2.03097
150.000	.1241E+02	.72151E+03	.06459	1.895988	2.02419	1755.9	1836.5	145.884	86.83	116.58	.92778E-05	1648	2.01482
160.000	.1225E+02	.71215E+03	.06135	1.768138	1.88966	2920.0	3001.6	153.400	86.04	116.38	.37222E-04	1598	1.99870
170.000	.1209E+02	.70279E+03	.05851	1.650774	1.76305	4083.7	4166.4	160.457	85.56	116.48	.12420E-03	1549	1.98259
180.000	.1193E+02	.69342E+03	.05601	1.542483	1.64334	5250.1	5333.9	167.125	85.42	116.92	.35606E-03	1499	1.96650
190.000	.1177E+02	.68401E+03	.05379	1.442103	1.52974	6422.3	6507.3	173.466	85.61	117.70	.89938E-03	1450	1.95039
200.000	.1161E+02	.67456E+03	.05182	1.348667	1.42163	7603.5	7689.7	179.530	86.10	118.79	.20421E-02	1400	1.93425
210.000	.1144E+02	.66503E+03	.05006	1.261362	1.31850	8796.8	8884.2	185.358	86.89	120.19	.42355E-02	1350	1.91804
220.000	.1128E+02	.65542E+03	.04848	1.179500	1.21995	10005.1	10093.8	190.988	87.93	121.87	.81306E-02	1300	1.90174
230.000	.1111E+02	.64569E+03	.04707	1.102486	1.12567	11231.4	11321.4	196.447	89.18	123.81	.14601E-01	1250	1.88532
240.000	.1094E+02	.63582E+03	.04581	1.029809	1.03538	12478.2	12569.6	201.761	90.63	125.98	.24750E-01	1199	1.86874
250.000	.1077E+02	.62578E+03	.04468	.961023	.94887	13748.0	13840.9	206.951	92.24	128.36	.39891E-01	1149	1.85196
260.000	.1059E+02	.61555E+03	.04368	.895732	.86598	15042.9	15137.3	212.035	93.98	130.93	.61516E-01	1098	1.83493
270.000	.1041E+02	.60508E+03	.04279	.833586	.78654	16364.9	16461.0	217.028	95.83	133.70	.91233E-01	1047	1.81762
280.000	.1023E+02	.59434E+03	.04201	.774270	.71045	17715.8	17813.6	221.943	97.77	136.65	.13070E+00	996	1.79994
290.000	.1003E+02	.58327E+03	.04133	.717494	.63760	19097.3	19197.0	226.792	99.79	139.79	.18152E+00	945	1.78185
300.000	.9838E+01	.57181E+03	.04075	.662989	.56789	20511.2	20612.9	231.588	101.87	143.15	.24517E+00	893	1.76324
310.000	.9633E+01	.55989E+03	.04028	.610501	.50125	21959.5	22063.3	236.339	103.99	146.73	.32292E+00	840	1.74401
320.000	.9418E+01	.54742E+03	.03991	.559773	.43758	23444.3	23550.5	241.058	106.15	150.60	.41573E+00	787	1.72403
330.000	.9192E+01	.53426E+03	.03965	.510543	.37679	24968.7	25077.5	245.756	108.32	154.81	.52418E+00	733	1.70313
340.000	.8951E+01	.52025E+03	.03952	.462516	.31876	26536.6	26648.4	250.445	110.48	159.48	.64851E+00	678	1.68107
350.000	.8691E+01	.50514E+03	.03954	.415336	.26337	28153.5	28268.6	255.143	112.60	164.82	.78850E+00	620	1.65749
352.538	.8621E+01	.50109E+03	.03957	.403442	.24970	28572.3	28688.3	256.337	113.12	166.32	.82663E+00	605	1.65121
352.538	.4273E+00	.24836E+02	.79843	.004618	.03021	43392.9	45733.2	304.686	110.71	134.17	.82663E+00	191	1.02668
360.000	.4092E+00	.23784E+02	.81646	.004279	.03281	44281.0	46724.8	307.468	111.27	131.91	.83766E+00	197	1.02554
370.000	.3887E+00	.22590E+02	.83637	.003937	.03590	45464.2	48037.2	311.064	112.66	130.85	.85053E+00	204	1.02425
380.000	.3711E+00	.21571E+02	.85282	.003671	.03870	46651.0	49345.5	314.553	114.42	130.95	.86189E+00	210	1.02315
390.000	.3558E+00	.20681E+02	.86672	.003454	.04129	47847.9	50658.4	317.963	116.39	131.71	.87200E+00	216	1.02219
400.000	.3422E+00	.19891E+02	.87865	.003273	.04373	49058.9	51981.1	321.312	118.49	132.88	.88105E+00	221	1.02133
410.000	.3300E+00	.19179E+02	.88902	.003116	.04604	50286.3	53316.9	324.610	120.65	134.32	.88920E+00	226	1.02056
420.000	.3188E+00	.18533E+02	.89812	.002980	.04826	51531.8	54668.1	327.866	122.86	135.94	.89660E+00	231	1.01987
430.000	.3087E+00	.17941E+02	.90617	.002859	.05039	52796.5	56036.2	331.085	125.10	137.70	.90330E+00	235	1.01923
440.000	.2993E+00	.17396E+02	.91333	.002751	.05246	54081.1	57422.4	334.272	127.36	139.55	.90941E+00	239	1.01864
450.000	.2906E+00	.16890E+02	.91975	.002653	.05447	55386.1	58827.4	337.429	129.61	141.46	.91500E+00	243	1.01810
460.000	.2825E+00	.16420E+02	.92553	.002564	.05644	56711.9	60251.7	340.560	131.86	143.41	.92013E+00	247	0.00000
470.000	.2749E+00	.15980E+02	.93076	.002482	.05836	58058.5	61695.8	343.665	134.10	145.40	.92485E+00	251	0.00000
480.000	.2678E+00	.15568E+02	.93550	.002407	.06024	59426.2	63159.8	346.747	136.33	147.40	.92921E+00	255	0.00000
490.000	.2612E+00	.15180E+02	.93982	.002338	.06209	60814.9	64643.9	349.807	138.54	149.42	.93323E+00	258	0.00000
500.000	.2549E+00	.14814E+02	.94377	.002273	.06391	62224.6	66148.1	352.846	140.73	151.43	.93696E+00	262	0.00000
520.000	.2433E+00	.14141E+02	.95071	.002155	.06748	65106.5	69217.0	358.864	145.04	155.45	.94363E+00	268	0.00000
540.000	.2328E+00	.13533E+02	.95661	.002052	.07097	68070.8	72365.8	364.805	149.26	159.42	.94942E+00	275	0.00000
560.000	.2233E+00	.12981E+02	.96165	.001959	.07439	71116.0	75593.5	370.674	153.37	163.34	.95447E+00	281	0.00000
580.000	.2147E+00	.12477E+02	.96600	.001876	.07775	74240.3	78898.8	376.473	157.37	167.17	.95890E+00	287	0.00000
620.000	.1994E+00	.11587E+02	.97308	.001731	.08433	80718.9	85735.1	387.868	165.05	174.58	.96628E+00	298	0.00000
660.000	.1862E+00	.10824E+02	.97853	.001609	.09076	87490.8	92860.6	399.003	172.28	181.63	.97215E+00	309	0.00000
700.000	.1748E+00	.10161E+02	.98281	.001505	.09709	94540.0	100260.1	409.886	179.10	188.29	.97683E+00	319	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 1.2 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
135.061	.1266E+02	.73562E+03	.08443	2.111098	2.24499	7.3	102.1	133.597	88.54	117.34	.63462E-06	1724	2.03911
140.000	.1258E+02	.73098E+03	.08197	2.036777	2.17014	585.7	681.2	137.806	87.92	117.04	.15575E-05	1699	2.03112
150.000	.1241E+02	.72161E+03	.07750	1.896736	2.02645	1752.8	1849.5	145.863	86.84	116.57	.78320E-05	1649	2.01498
160.000	.1225E+02	.71225E+03	.07361	1.768923	1.89198	2916.6	3014.5	153.378	86.05	116.37	.31401E-04	1599	1.99887
170.000	.1209E+02	.70290E+03	.07020	1.651594	1.76541	4080.0	4179.2	160.435	85.57	116.47	.10472E-03	1550	1.98278
180.000	.1193E+02	.69354E+03	.06720	1.543336	1.64576	5246.0	5346.6	167.103	85.43	116.91	.30006E-03	1500	1.96670
190.000	.1177E+02	.68414E+03	.06454	1.442990	1.53222	6417.9	6519.8	173.443	85.62	117.68	.75759E-03	1451	1.95060
200.000	.1161E+02	.67470E+03	.06217	1.349588	1.42416	7598.7	7702.1	179.506	86.11	118.77	.17195E-02	1401	1.93448
210.000	.1144E+02	.66518E+03	.06005	1.262319	1.32109	8791.5	8896.4	185.333	86.90	120.17	.35651E-02	1351	1.91829
220.000	.1128E+02	.65558E+03	.05816	1.180493	1.22261	9999.4	10105.8	190.961	87.94	121.85	.68415E-02	1301	1.90201
230.000	.1111E+02	.64586E+03	.05647	1.103519	1.12839	11225.1	11333.1	196.420	89.19	123.78	.12283E-01	1251	1.88561
240.000	.1094E+02	.63601E+03	.05496	1.030885	1.03817	12471.4	12581.0	201.733	90.64	125.94	.20815E-01	1201	1.86905
250.000	.1077E+02	.62599E+03	.05360	.962145	.95174	13740.5	13851.9	206.921	92.25	128.32	.33541E-01	1150	1.85230
260.000	.1059E+02	.61578E+03	.05240	.896906	.86892	15034.7	15148.0	212.003	93.99	130.89	.51713E-01	1100	1.83531
270.000	.1041E+02	.60534E+03	.05133	.834818	.78957	16355.9	16471.1	216.994	95.84	133.64	.76681E-01	1049	1.81803
280.000	.1023E+02	.59462E+03	.05039	.775566	.71356	17705.8	17823.1	221.907	97.78	136.58	.10983E+00	998	1.80040
290.000	.1004E+02	.58358E+03	.04957	.718864	.64080	19086.2	19205.8	226.754	99.80	139.71	.15252E+00	947	1.78235
300.000	.9844E+01	.57216E+03	.04887	.664445	.57120	20498.9	20620.8	231.546	101.88	143.05	.20598E+00	895	1.76380
310.000	.9640E+01	.56029E+03	.04830	.612056	.50466	21945.6	22070.1	236.294	104.00	146.61	.27128E+00	843	1.74464
320.000	.9426E+01	.54787E+03	.04785	.561447	.44111	23428.6	23555.9	241.008	106.16	150.44	.34921E+00	790	1.72475
330.000	.9201E+01	.53479E+03	.04753	.512361	.38045	24950.7	25081.1	245.701	108.33	154.61	.44030E+00	736	1.70396
340.000	.8961E+01	.52087E+03	.04737	.464516	.32259	26515.7	26649.6	250.383	110.49	159.21	.54471E+00	681	1.68204
350.000	.8704E+01	.50589E+03	.04738	.417571	.26739	28128.7	28266.6	255.072	112.60	164.43	.66230E+00	624	1.65865
360.000	.8421E+01	.48949E+03	.04761	.371069	.21465	29797.8	29940.3	259.788	114.61	170.63	.79257E+00	565	1.63330
361.146	.8387E+01	.48750E+03	.04765	.365740	.20876	29992.7	30135.8	260.329	114.84	171.44	.80840E+00	558	1.63024
361.146	.5188E+00	.30154E+02	.77033	.005826	.02818	44049.2	46362.3	305.260	114.07	141.88	.80840E+00	187	1.03247
370.000	.4906E+00	.28515E+02	.79511	.005272	.03162	45151.3	47597.3	308.636	114.45	137.70	.82261E+00	195	1.03068
380.000	.4646E+00	.27002E+02	.81758	.004822	.03497	46380.2	48963.4	312.280	115.70	135.84	.83653E+00	202	1.02904
390.000	.4426E+00	.25728E+02	.83604	.004477	.03797	47607.9	50318.9	315.801	117.36	135.44	.84881E+00	209	1.02766
400.000	.4237E+00	.24627E+02	.85159	.004198	.04074	48842.5	51674.8	319.233	119.25	135.84	.85975E+00	215	1.02646
410.000	.4070E+00	.23656E+02	.86492	.003967	.04332	50088.9	53037.4	322.598	121.28	136.75	.86957E+00	221	1.02541
420.000	.3921E+00	.22788E+02	.87650	.003769	.04576	51350.0	54410.8	325.907	123.38	137.98	.87845E+00	226	1.02447
430.000	.3786E+00	.22003E+02	.88664	.003597	.04809	52627.7	55797.7	329.171	125.54	139.44	.88648E+00	231	1.02362
440.000	.3662E+00	.21288E+02	.89562	.003446	.05032	53923.5	57200.0	332.395	127.73	141.05	.89378E+00	235	1.02285
450.000	.3549E+00	.20630E+02	.90361	.003311	.05248	55238.2	58619.0	335.584	129.94	142.77	.90045E+00	240	1.02214
460.000	.3445E+00	.20023E+02	.91077	.003190	.05458	56572.3	60055.7	338.741	132.15	144.58	.90656E+00	244	0.00000
470.000	.3348E+00	.19460E+02	.91721	.003079	.05662	57926.5	61510.8	341.870	134.35	146.44	.91218E+00	248	0.00000
480.000	.3257E+00	.18934E+02	.92304	.002979	.05861	59300.8	62984.6	344.973	136.55	148.33	.91735E+00	252	0.00000
490.000	.3173E+00	.18442E+02	.92833	.002886	.06056	60695.4	64477.5	348.051	138.74	150.26	.92213E+00	256	0.00000
500.000	.3093E+00	.17980E+02	.93316	.002801	.06247	62110.5	65989.8	351.107	140.91	152.20	.92655E+00	259	0.00000
520.000	.2948E+00	.17133E+02	.94160	.002648	.06620	65001.6	69072.7	357.152	145.19	156.09	.93445E+00	266	0.00000
540.000	.2817E+00	.16374E+02	.94874	.002513	.06982	67973.7	72233.4	363.116	149.38	159.97	.94130E+00	273	0.00000
560.000	.2699E+00	.15689E+02	.95483	.002395	.07336	71025.5	75471.4	369.003	153.47	163.81	.94727E+00	279	0.00000
580.000	.2592E+00	.15065E+02	.96007	.002289	.07682	74155.6	78785.5	374.817	157.46	167.59	.95250E+00	285	0.00000
620.000	.2403E+00	.13970E+02	.96856	.002106	.08358	80643.7	85636.6	386.237	165.11	174.91	.96118E+00	297	0.00000
660.000	.2243E+00	.13035E+02	.97508	.001953	.09016	87423.0	92773.8	397.391	172.34	181.89	.96807E+00	308	0.00000
700.000	.2104E+00	.12226E+02	.98017	.001824	.09661	94478.3	100183.1	408.288	179.14	188.51	.97357E+00	318	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 1.4 MPa

Temp. K	Density mol/L	Density kg/m^3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m^3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
135.095	.1266E+02	.73568E+03	.09847	2.111268	2.24667	8.5	119.1	133.606	88.55	117.33	.55518E-06	1725	2.03920
140.000	.1258E+02	.73107E+03	.09562	2.037485	2.17235	582.9	694.2	137.785	87.93	117.03	.13534E-05	1700	2.03127
150.000	.1242E+02	.72171E+03	.09041	1.897483	2.02872	1749.7	1862.4	145.842	86.85	116.56	.68004E-05	1650	2.01514
160.000	.1226E+02	.71236E+03	.08587	1.769707	1.89429	2913.2	3027.4	153.357	86.06	116.36	.27247E-04	1600	1.99904
170.000	.1210E+02	.70302E+03	.08189	1.652412	1.76778	4076.2	4192.0	160.413	85.58	116.46	.90818E-04	1551	1.98296
180.000	.1193E+02	.69366E+03	.07838	1.544189	1.64818	5242.0	5359.3	167.080	85.44	116.90	.26009E-03	1501	1.96690
190.000	.1177E+02	.68427E+03	.07528	1.443875	1.53469	6413.5	6532.4	173.420	85.63	117.67	.65638E-03	1452	1.95082
200.000	.1161E+02	.67484E+03	.07251	1.350507	1.42670	7593.9	7714.5	179.482	86.12	118.76	.14892E-02	1402	1.93470
210.000	.1145E+02	.66533E+03	.07005	1.263273	1.32369	8786.3	8908.6	185.308	86.91	120.15	.30865E-02	1352	1.91853
220.000	.1128E+02	.65574E+03	.06784	1.181485	1.22527	9993.7	10117.8	190.935	87.95	121.83	.59213E-02	1302	1.90227
230.000	.1111E+02	.64604E+03	.06587	1.104550	1.13112	11218.9	11344.9	196.392	89.20	123.75	.10628E-01	1252	1.88589
240.000	.1095E+02	.63620E+03	.06410	1.031959	1.04097	12464.6	12592.5	201.704	90.65	125.91	.18005E-01	1202	1.86936
250.000	.1077E+02	.62620E+03	.06252	.963265	.95461	13733.1	13863.0	206.891	92.26	128.28	.29008E-01	1152	1.85264
260.000	.1060E+02	.61601E+03	.06111	.898077	.87186	15026.5	15158.6	211.972	94.00	130.84	.44714E-01	1101	1.83568
270.000	.1042E+02	.60559E+03	.05986	.836046	.79259	16346.9	16481.2	216.961	95.85	133.59	.66291E-01	1051	1.81843
280.000	.1023E+02	.59490E+03	.05876	.776858	.71667	17695.9	17832.7	221.871	97.79	136.52	.94935E-01	1000	1.80085
290.000	.1005E+02	.58389E+03	.05780	.720229	.64400	19075.2	19214.6	226.716	99.81	139.63	.13181E+00	949	1.78285
300.000	.9850E+01	.57251E+03	.05698	.665894	.57449	20486.6	20628.7	231.505	101.89	142.95	.17800E+00	897	1.76435
310.000	.9646E+01	.56068E+03	.05631	.613602	.50806	21931.8	22076.9	236.249	104.01	146.49	.23440E+00	845	1.74527
320.000	.9434E+01	.54832E+03	.05578	.563110	.44462	23413.0	23561.4	240.959	106.17	150.29	.30172E+00	793	1.72547
330.000	.9210E+01	.53531E+03	.05540	.514166	.38410	24932.9	25084.9	245.646	108.34	154.41	.38040E+00	739	1.70478
340.000	.8972E+01	.52149E+03	.05520	.466496	.32639	26495.0	26651.0	250.322	110.49	158.95	.47059E+00	685	1.68300
350.000	.8716E+01	.50664E+03	.05519	.419779	.27138	28104.3	28264.9	255.001	112.60	164.06	.57218E+00	628	1.65980
360.000	.8437E+01	.49041E+03	.05544	.373587	.21888	29768.1	29934.1	259.705	114.61	170.09	.68475E+00	569	1.63472
368.760	.8166E+01	.47464E+03	.05592	.333057	.17477	31279.4	31450.9	263.868	116.25	176.63	.79185E+00	515	1.61059
368.760	.6143E+00	.35708E+02	.74325	.007155	.02611	44612.2	46891.0	305.738	117.19	150.15	.79185E+00	182	1.03854
370.000	.6086E+00	.35375E+02	.74773	.007029	.02670	44776.1	47076.4	306.238	117.10	148.90	.79430E+00	184	1.03817
380.000	.5691E+00	.33078E+02	.77861	.006238	.03087	46070.5	48530.5	310.116	117.37	142.82	.81102E+00	193	1.03566
390.000	.5377E+00	.31255E+02	.80291	.005686	.03441	47341.0	49944.5	313.789	118.56	140.36	.82562E+00	201	1.03367
400.000	.5116E+00	.29735E+02	.82284	.005266	.03758	48606.6	51343.2	317.331	120.16	139.56	.83853E+00	208	1.03202
410.000	.4891E+00	.28430E+02	.83962	.004928	.04048	49876.6	52738.9	320.777	122.00	139.69	.85006E+00	215	1.03060
420.000	.4694E+00	.27286E+02	.85400	.004648	.04317	51156.6	54138.8	324.150	123.97	140.38	.86046E+00	221	1.02935
430.000	.4519E+00	.26268E+02	.86648	.004410	.04572	52449.8	55547.7	327.465	126.03	141.44	.86983E+00	226	1.02825
440.000	.4361E+00	.25350E+02	.87743	.004204	.04814	53758.5	56968.5	330.732	128.15	142.75	.87833E+00	231	1.02725
450.000	.4218E+00	.24516E+02	.88712	.004023	.05046	55084.1	58403.3	333.956	130.29	144.24	.88609E+00	236	1.02635
460.000	.4086E+00	.23752E+02	.89575	.003861	.05270	56427.8	59853.8	337.144	132.45	145.86	.89319E+00	240	0.00000
470.000	.3965E+00	.23048E+02	.90349	.003717	.05487	57790.2	61320.9	340.299	134.62	147.57	.89970E+00	245	0.00000
480.000	.3853E+00	.22395E+02	.91046	.003586	.05697	59171.8	62805.4	343.425	136.79	149.35	.90569E+00	249	0.00000
490.000	.3748E+00	.21787E+02	.91676	.003467	.05902	60573.0	64308.0	346.523	138.95	151.17	.91122E+00	253	0.00000
500.000	.3651E+00	.21219E+02	.92249	.003357	.06103	61993.9	65828.9	349.595	141.10	153.02	.91633E+00	257	0.00000
520.000	.3473E+00	.20184E+02	.93249	.003163	.06492	64895.0	68926.7	355.670	145.34	156.77	.92546E+00	264	0.00000
540.000	.3314E+00	.19262E+02	.94091	.002994	.06868	67875.4	72100.0	361.657	149.51	160.55	.93335E+00	271	0.00000
560.000	.3172E+00	.18434E+02	.94807	.002846	.07234	70934.3	75348.6	367.564	153.58	164.31	.94023E+00	278	0.00000
580.000	.3042E+00	.17684E+02	.95420	.002715	.07591	74070.4	78672.0	373.395	157.55	168.02	.94624E+00	284	0.00000
620.000	.2817E+00	.16373E+02	.96411	.002491	.08285	80568.3	85538.3	384.840	165.18	175.25	.95622E+00	296	0.00000
660.000	.2626E+00	.15261E+02	.97169	.002305	.08957	87355.4	92687.6	396.012	172.39	182.16	.96412E+00	307	0.00000
700.000	.2461E+00	.14302E+02	.97760	.002148	.09614	94416.9	100106.6	406.924	179.18	188.73	.97042E+00	318	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 1.6 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
135.128	.1266E+02	.73573E+03	.11251	2.111439	2.24834	9.7	136.1	133.615	88.56	117.33	.49579E-06	1725	2.03929
140.000	.1258E+02	.73116E+03	.10927	2.038193	2.17457	580.1	707.3	137.765	87.94	117.02	.12005E-05	1701	2.03142
150.000	.1242E+02	.72180E+03	.10331	1.898231	2.03098	1746.6	1875.4	145.821	86.86	116.55	.60277E-05	1650	2.01530
160.000	.1226E+02	.71247E+03	.09812	1.770490	1.89660	2909.7	3040.3	153.336	86.07	116.35	.24136E-04	1601	1.99921
170.000	.1210E+02	.70313E+03	.09357	1.653231	1.77014	4072.5	4204.8	160.391	85.59	116.45	.80400E-04	1551	1.98315
180.000	.1194E+02	.69378E+03	.08957	1.545040	1.65059	5237.9	5372.0	167.058	85.45	116.89	.23014E-03	1502	1.96709
190.000	.1177E+02	.68440E+03	.08602	1.444760	1.53716	6409.1	6544.9	173.396	85.64	117.65	.58054E-03	1453	1.95103
200.000	.1161E+02	.67498E+03	.08286	1.351426	1.42923	7589.1	7726.8	179.457	86.13	118.74	.13166E-02	1403	1.93493
210.000	.1145E+02	.66548E+03	.08004	1.264227	1.32628	8781.0	8920.8	185.283	86.92	120.13	.27279E-02	1353	1.91878
220.000	.1128E+02	.65591E+03	.07751	1.182475	1.22793	9988.0	10129.8	190.909	87.96	121.80	.52316E-02	1304	1.90254
230.000	.1112E+02	.64622E+03	.07525	1.105579	1.13384	11212.7	11356.6	196.365	89.21	123.73	.93872E-02	1253	1.88618
240.000	.1095E+02	.63640E+03	.07323	1.033030	1.04376	12457.8	12603.9	201.676	90.66	125.88	.15900E-01	1203	1.86967
250.000	.1078E+02	.62641E+03	.07142	.964383	.95747	13725.6	13874.1	206.861	92.27	128.24	.25609E-01	1153	1.85298
260.000	.1060E+02	.61624E+03	.06981	.899245	.87480	15018.4	15169.3	211.940	94.01	130.80	.39468E-01	1103	1.83605
270.000	.1042E+02	.60584E+03	.06838	.837270	.79561	16337.9	16491.4	216.927	95.86	133.53	.58503E-01	1052	1.81884
280.000	.1024E+02	.59518E+03	.06712	.778146	.71977	17686.0	17842.3	221.836	97.80	136.45	.83768E-01	1002	1.80129
290.000	.1005E+02	.58420E+03	.06602	.721588	.64719	19064.3	19223.5	226.678	99.82	139.55	.11629E+00	951	1.78334
300.000	.9856E+01	.57286E+03	.06508	.667336	.57777	20474.4	20636.7	231.464	101.90	142.85	.15702E+00	900	1.76491
310.000	.9653E+01	.56108E+03	.06431	.615141	.51145	21918.1	22083.8	236.205	104.02	146.37	.20676E+00	848	1.74589
320.000	.9441E+01	.54877E+03	.06369	.564763	.44813	23397.5	23567.0	240.910	106.18	150.14	.26612E+00	796	1.72617
330.000	.9219E+01	.53583E+03	.06326	.515957	.38773	24915.2	25088.7	245.592	108.35	154.21	.33549E+00	742	1.70560
340.000	.8982E+01	.52210E+03	.06301	.468458	.33018	26474.5	26652.6	250.261	110.50	158.69	.41503E+00	688	1.68395
350.000	.8729E+01	.50737E+03	.06299	.421961	.27534	28080.2	28263.5	254.932	112.60	163.71	.50462E+00	632	1.66093
360.000	.8453E+01	.49132E+03	.06324	.376065	.22307	29739.0	29928.3	259.623	114.61	169.56	.60391E+00	574	1.63610
370.000	.8145E+01	.47343E+03	.06385	.330183	.17314	31462.0	31658.5	264.364	116.45	176.87	.71227E+00	512	1.60874
375.611	.7953E+01	.46226E+03	.06442	.304087	.14600	32464.0	32665.2	267.065	117.39	182.10	.77662E+00	475	1.59181
375.611	.7147E+00	.41542E+02	.71683	.008619	.02400	45099.7	47338.3	306.130	120.15	159.30	.77662E+00	178	1.04494
380.000	.6897E+00	.40086E+02	.73428	.008061	.02623	45704.5	48024.4	307.943	119.73	153.78	.78519E+00	183	1.04334
390.000	.6437E+00	.37415E+02	.76654	.007152	.03054	47039.0	49524.6	311.841	120.08	147.20	.80231E+00	193	1.04041
400.000	.6075E+00	.35308E+02	.79197	.006513	.03422	48346.6	50980.5	315.527	121.26	144.38	.81731E+00	201	1.03811
410.000	.5774E+00	.33561E+02	.81287	.006025	.03749	49646.9	52417.9	319.076	122.84	143.32	.83063E+00	209	1.03620
420.000	.5517E+00	.32068E+02	.83047	.005633	.04049	50950.0	53850.1	322.527	124.64	143.24	.84257E+00	215	1.03457
430.000	.5293E+00	.30762E+02	.84558	.005308	.04328	52261.6	55284.8	325.903	126.58	143.77	.85331E+00	221	1.03314
440.000	.5093E+00	.29604E+02	.85871	.005032	.04591	53585.4	56726.8	329.218	128.60	144.70	.86306E+00	227	1.03188
450.000	.4914E+00	.28562E+02	.87024	.004793	.04841	54923.6	58179.6	332.483	130.68	145.90	.87191E+00	232	1.03075
460.000	.4751E+00	.27617E+02	.88045	.004584	.05080	56278.0	59645.4	335.705	132.79	147.29	.87999E+00	237	0.00000
470.000	.4603E+00	.26753E+02	.88956	.004398	.05310	57649.6	61125.8	338.888	134.91	148.82	.88740E+00	242	0.00000
480.000	.4466E+00	.25957E+02	.89773	.004231	.05533	59039.3	62622.1	342.038	137.04	150.44	.89421E+00	246	0.00000
490.000	.4339E+00	.25220E+02	.90510	.004081	.05748	60447.5	64135.0	345.158	139.17	152.14	.90049E+00	250	0.00000
500.000	.4221E+00	.24535E+02	.91177	.003943	.05959	61874.7	65665.2	348.249	141.30	153.90	.90629E+00	254	0.00000
520.000	.4008E+00	.23295E+02	.92337	.003702	.06365	64786.7	68778.9	354.355	145.50	157.49	.91663E+00	262	0.00000
540.000	.3819E+00	.22198E+02	.93310	.003494	.06756	67775.9	71965.3	360.367	149.64	161.15	.92557E+00	269	0.00000
560.000	.3650E+00	.21218E+02	.94134	.003314	.07134	70842.1	75225.1	366.294	153.69	164.82	.93334E+00	276	0.00000
580.000	.3498E+00	.20334E+02	.94838	.003155	.07502	73984.6	78558.1	372.142	157.65	168.46	.94014E+00	283	0.00000
620.000	.3234E+00	.18798E+02	.95972	.002886	.08213	80492.7	85440.0	383.614	165.25	175.59	.95141E+00	295	0.00000
660.000	.3011E+00	.17501E+02	.96836	.002665	.08900	87287.7	92601.7	394.805	172.44	182.44	.96030E+00	306	0.00000
700.000	.2819E+00	.16387E+02	.97508	.002479	.09569	94355.6	100030.7	405.731	179.23	188.96	.96738E+00	317	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 1.8 MPa

Temp. K	Density mol/L	Density kg/m^3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m^3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
135.162	.1266E+02	.73579E+03	.12653	2.111610	2.25002	10.9	153.1	133.624	88.56	117.32	.44978E-06	1726	2.03938
140.000	.1258E+02	.73125E+03	.12291	2.038900	2.17678	577.2	720.3	137.745	87.95	117.02	.10818E-05	1701	2.03157
150.000	.1242E+02	.72190E+03	.11620	1.898978	2.03324	1743.5	1888.4	145.801	86.87	116.55	.54276E-05	1651	2.01546
160.000	.1226E+02	.71257E+03	.11037	1.771274	1.89891	2906.4	3053.2	153.314	86.08	116.34	.21719E-04	1602	1.99938
170.000	.1210E+02	.70324E+03	.10525	1.654048	1.77250	4068.8	4217.6	160.369	85.60	116.44	.72308E-04	1552	1.98333
180.000	.1194E+02	.69390E+03	.10075	1.545891	1.65301	5233.9	5384.7	167.035	85.46	116.87	.20687E-03	1503	1.96729
190.000	.1178E+02	.68453E+03	.09675	1.445644	1.53964	6404.7	6557.5	173.373	85.65	117.64	.52162E-03	1454	1.95124
200.000	.1162E+02	.67512E+03	.09319	1.352344	1.43176	7584.3	7739.2	179.433	86.15	118.72	.11825E-02	1404	1.93516
210.000	.1145E+02	.66564E+03	.09002	1.265180	1.32887	8775.8	8933.0	185.258	86.93	120.11	.24492E-02	1355	1.91902
220.000	.1129E+02	.65607E+03	.08718	1.183464	1.23058	9982.3	10141.8	190.883	87.97	121.78	.46955E-02	1305	1.90280
230.000	.1112E+02	.64639E+03	.08464	1.106607	1.13656	11206.5	11368.3	196.338	89.22	123.70	.84230E-02	1255	1.88647
240.000	.1095E+02	.63659E+03	.08236	1.034100	1.04655	12451.0	12615.4	201.647	90.67	125.85	.14263E-01	1205	1.86999
250.000	.1078E+02	.62662E+03	.08032	.965498	.96033	13718.2	13885.2	206.832	92.28	128.20	.22968E-01	1155	1.85332
260.000	.1061E+02	.61647E+03	.07851	.900411	.87773	15010.3	15180.0	211.909	94.02	130.75	.35390E-01	1104	1.83642
270.000	.1043E+02	.60609E+03	.07689	.838492	.79862	16329.0	16501.6	216.894	95.87	133.48	.52449E-01	1054	1.81925
280.000	.1024E+02	.59546E+03	.07547	.779430	.72286	17676.2	17851.9	221.801	97.81	136.39	.75088E-01	1003	1.80174
290.000	.1006E+02	.58451E+03	.07423	.722943	.65037	19053.4	19232.4	226.640	99.83	139.48	.10423E+00	953	1.78384
300.000	.9862E+01	.57320E+03	.07318	.668772	.58105	20462.2	20644.8	231.423	101.91	142.76	.14072E+00	902	1.76546
310.000	.9660E+01	.56147E+03	.07230	.616672	.51482	21904.5	22090.8	236.160	104.03	146.25	.18527E+00	850	1.74651
320.000	.9449E+01	.54922E+03	.07160	.566406	.45162	23382.1	23572.6	240.862	106.19	149.99	.23844E+00	798	1.72688
330.000	.9228E+01	.53634E+03	.07109	.517734	.39135	24897.6	25092.7	245.538	108.35	154.02	.30058E+00	745	1.70640
340.000	.8993E+01	.52270E+03	.07080	.470403	.33394	26454.3	26654.4	250.201	110.50	158.43	.37183E+00	691	1.68489
350.000	.8741E+01	.50809E+03	.07076	.424118	.27928	28056.4	28262.3	254.863	112.60	163.36	.45209E+00	636	1.66205
360.000	.8468E+01	.49221E+03	.07101	.378507	.22723	29710.4	29922.9	259.543	114.60	169.06	.54107E+00	578	1.63746
370.000	.8165E+01	.47457E+03	.07166	.333030	.17758	31426.3	31646.8	264.266	116.44	176.08	.63820E+00	518	1.61046
380.000	.7816E+01	.45431E+03	.07289	.286764	.12998	33222.6	33452.9	269.082	118.04	185.74	.74261E+00	452	1.57983
381.856	.7744E+01	.45013E+03	.07321	.277964	.12132	33567.9	33800.3	269.995	118.30	188.07	.76250E+00	439	1.57358
381.856	.8207E+00	.47705E+02	.69077	.010235	.02186	45522.9	47716.0	306.438	123.00	169.73	.76250E+00	173	1.05174
390.000	.7650E+00	.44463E+02	.72566	.008992	.02624	46688.1	49041.2	309.870	122.10	157.44	.77876E+00	183	1.04816
400.000	.7137E+00	.41481E+02	.75838	.007999	.03060	48056.0	50578.2	313.761	122.60	150.85	.79602E+00	194	1.04488
410.000	.6732E+00	.39130E+02	.78432	.007290	.03435	49396.2	52069.9	317.445	123.82	147.90	.81123E+00	202	1.04230
420.000	.6397E+00	.37184E+02	.80572	.006744	.03770	50728.2	53541.9	320.992	125.40	146.70	.82477E+00	210	1.04016
430.000	.6111E+00	.35522E+02	.82381	.006305	.04076	52062.0	55007.3	324.440	127.19	146.50	.83691E+00	216	1.03834
440.000	.5862E+00	.34072E+02	.83936	.005941	.04362	53403.3	56474.0	327.812	129.10	146.93	.84790E+00	222	1.03676
450.000	.5641E+00	.32786E+02	.85290	.005631	.04631	54756.0	57947.1	331.122	131.10	147.76	.85785E+00	228	1.03535
460.000	.5442E+00	.31631E+02	.86482	.005362	.04887	56122.4	59430.1	334.381	133.14	148.87	.86693E+00	233	0.00000
470.000	.5262E+00	.30584E+02	.87539	.005127	.05131	57504.4	60925.2	337.597	135.22	150.18	.87524E+00	238	0.00000
480.000	.5097E+00	.29627E+02	.88483	.004918	.05366	58902.9	62434.2	340.774	137.31	151.64	.88287E+00	243	0.00000
490.000	.4946E+00	.28747E+02	.89331	.004731	.05594	60318.9	63958.3	343.916	139.41	153.20	.88990E+00	247	0.00000
500.000	.4806E+00	.27933E+02	.90097	.004561	.05814	61752.9	65498.5	347.028	141.51	154.84	.89638E+00	252	0.00000
520.000	.4554E+00	.26469E+02	.91423	.004266	.06238	64676.4	68629.1	353.167	145.67	158.26	.90794E+00	260	0.00000
540.000	.4333E+00	.25184E+02	.92530	.004015	.06644	67675.0	71829.5	359.205	149.78	161.79	.91791E+00	267	0.00000
560.000	.4136E+00	.24041E+02	.93464	.003799	.07035	70749.1	75100.9	365.154	153.81	165.36	.92658E+00	275	0.00000
580.000	.3960E+00	.23016E+02	.94261	.003609	.07414	73898.1	78443.8	371.019	157.74	168.93	.93415E+00	281	0.00000
620.000	.3655E+00	.21243E+02	.95540	.003291	.08143	80416.8	85341.8	382.517	165.33	175.94	.94668E+00	294	0.00000
660.000	.3399E+00	.19755E+02	.96510	.003032	.08845	87220.0	92516.0	393.728	172.50	182.72	.95656E+00	306	0.00000
700.000	.3180E+00	.18482E+02	.97263	.002816	.09525	94294.4	99955.2	404.669	179.27	189.19	.96443E+00	317	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 2.0 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	Cv J/(mol•K)	Cp J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
135.195	.1266E+02	.73585E+03	.14054	2.111782	2.25169	12.1	170.1	133.633	88.57	117.31	.41313E-06	1726	2.03947
140.000	.1258E+02	.73135E+03	.13655	2.039608	2.17899	574.4	733.3	137.724	87.97	117.01	.98699E-06	1702	2.03171
150.000	.1242E+02	.72200E+03	.12910	1.899724	2.03550	1740.4	1901.4	145.780	86.88	116.54	.49483E-05	1652	2.01561
160.000	.1226E+02	.71268E+03	.12261	1.772057	1.90122	2903.0	3066.1	153.293	86.09	116.33	.19788E-04	1602	1.99955
170.000	.1210E+02	.70335E+03	.11693	1.654865	1.77486	4065.1	4230.4	160.347	85.61	116.43	.65843E-04	1553	1.98351
180.000	.1194E+02	.69402E+03	.11192	1.546741	1.65542	5229.8	5397.3	167.012	85.47	116.86	.18828E-03	1504	1.96749
190.000	.1178E+02	.68466E+03	.10748	1.446528	1.54210	6400.3	6570.1	173.350	85.66	117.62	.47453E-03	1455	1.95145
200.000	.1162E+02	.67526E+03	.10353	1.353260	1.43428	7579.5	7751.7	179.409	86.16	118.71	.10753E-02	1405	1.93539
210.000	.1145E+02	.66579E+03	.10000	1.266131	1.33146	8770.6	8945.2	185.233	86.94	120.09	.22264E-02	1356	1.91927
220.000	.1129E+02	.65623E+03	.09684	1.184452	1.23323	9976.6	10153.8	190.857	87.98	121.76	.42671E-02	1306	1.90307
230.000	.1112E+02	.64657E+03	.09402	1.107633	1.13927	11200.3	11380.1	196.311	89.23	123.67	.76523E-02	1256	1.88675
240.000	.1096E+02	.63678E+03	.09149	1.035168	1.04933	12444.3	12626.8	201.619	90.68	125.82	.12955E-01	1206	1.87030
250.000	.1078E+02	.62683E+03	.08922	.966611	.96318	13710.9	13896.3	206.802	92.29	128.17	.20856E-01	1156	1.85365
260.000	.1061E+02	.61670E+03	.08720	.901573	.88066	15002.2	15190.7	211.878	94.03	130.71	.32130E-01	1106	1.83679
270.000	.1043E+02	.60634E+03	.08540	.839709	.80162	16320.1	16511.8	216.861	95.88	133.43	.47609E-01	1056	1.81965
280.000	.1025E+02	.59573E+03	.08382	.780709	.72595	17666.4	17861.5	221.765	97.82	136.32	.68148E-01	1005	1.80218
290.000	.1006E+02	.58482E+03	.08244	.724293	.65354	19042.5	19241.3	226.602	99.84	139.40	.94582E-01	955	1.78433
300.000	.9868E+01	.57355E+03	.08126	.670202	.58432	20450.2	20652.8	231.382	101.91	142.66	.12768E+00	904	1.76601
310.000	.9666E+01	.56185E+03	.08027	.618195	.51819	21891.0	22097.9	236.116	104.04	146.13	.16809E+00	853	1.74713
320.000	.9457E+01	.54966E+03	.07949	.568039	.45510	23366.9	23578.4	240.814	106.19	149.84	.21631E+00	801	1.72757
330.000	.9236E+01	.53685E+03	.07892	.519499	.39496	24880.3	25096.8	245.485	108.36	153.84	.27267E+00	748	1.70720
340.000	.9003E+01	.52330E+03	.07858	.472330	.33769	26434.2	26656.4	250.141	110.51	158.19	.33729E+00	695	1.68582
350.000	.8754E+01	.50880E+03	.07851	.426251	.28320	28032.9	28261.4	254.795	112.61	163.02	.41009E+00	640	1.66315
360.000	.8483E+01	.49308E+03	.07876	.380912	.23135	29682.2	29918.0	259.463	114.60	168.58	.49082E+00	583	1.63880
370.000	.8184E+01	.47568E+03	.07944	.335820	.18198	31391.4	31635.8	264.170	116.42	175.33	.57896E+00	523	1.61215
380.000	.7842E+01	.45582E+03	.08072	.290155	.13476	33177.0	33432.0	268.959	118.00	184.42	.67377E+00	458	1.58210
387.601	.7537E+01	.43810E+03	.08234	.254082	.09994	34606.4	34871.7	272.712	118.99	194.81	.74932E+00	404	1.55563
387.601	.9335E+00	.54262E+02	.66477	.012025	.01970	45888.9	48031.3	306.663	125.80	181.95	.74932E+00	168	1.05901
390.000	.9099E+00	.52888E+02	.67784	.011452	.02127	46261.0	48459.0	307.761	125.09	175.05	.75477E+00	172	1.05748
400.000	.8339E+00	.48472E+02	.72112	.009816	.02665	47724.1	50122.4	311.973	124.30	160.09	.77457E+00	185	1.05259
410.000	.7786E+00	.45254E+02	.75355	.008770	.03099	49119.3	51688.1	315.839	124.98	153.86	.79178E+00	195	1.04904
420.000	.7347E+00	.42706E+02	.77950	.008010	.03476	50488.3	53210.4	319.508	126.26	150.97	.80700E+00	203	1.04623
430.000	.6984E+00	.40592E+02	.80103	.007419	.03815	51849.1	54713.0	323.043	127.86	149.75	.82057E+00	211	1.04391
440.000	.6673E+00	.38785E+02	.81929	.006941	.04126	53211.3	56208.6	326.481	129.65	149.50	.83283E+00	218	1.04192
450.000	.6401E+00	.37207E+02	.83505	.006542	.04416	54580.6	57705.0	329.844	131.55	149.86	.84390E+00	224	1.04019
460.000	.6161E+00	.35808E+02	.84882	.006202	.04690	55960.8	59207.2	333.146	133.53	150.63	.85399E+00	230	0.00000
470.000	.5945E+00	.34552E+02	.86095	.005908	.04950	57354.1	60718.6	336.396	135.55	151.68	.86320E+00	235	0.00000
480.000	.5749E+00	.33414E+02	.87174	.005649	.05199	58762.5	62241.6	339.603	137.60	152.94	.87165E+00	240	0.00000
490.000	.5570E+00	.32373E+02	.88139	.005419	.05438	60186.9	63777.8	342.770	139.66	154.34	.87942E+00	245	0.00000
500.000	.5405E+00	.31416E+02	.89008	.005213	.05669	61628.4	65328.6	345.903	141.73	155.84	.88659E+00	249	0.00000
520.000	.5111E+00	.29708E+02	.90506	.004856	.06111	64564.2	68477.3	352.078	145.85	159.06	.89936E+00	258	0.00000
540.000	.4855E+00	.28219E+02	.91751	.004557	.06532	67572.8	71692.2	358.144	149.92	162.45	.91036E+00	266	0.00000
560.000	.4629E+00	.26905E+02	.92798	.004301	.06936	70655.0	74975.8	364.114	153.92	165.92	.91992E+00	273	0.00000
580.000	.4427E+00	.25730E+02	.93688	.004078	.07326	73810.9	78329.0	369.997	157.84	169.40	.92826E+00	280	0.00000
620.000	.4079E+00	.23710E+02	.95112	.003707	.08075	80340.6	85243.6	381.524	165.40	176.31	.94205E+00	293	0.00000
660.000	.3789E+00	.22023E+02	.96189	.003407	.08791	87152.2	92430.7	392.755	172.56	183.00	.95291E+00	305	0.00000
700.000	.3542E+00	.20586E+02	.97023	.003159	.09483	94233.3	99880.2	403.711	179.32	189.42	.96154E+00	316	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 2.2 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	Cv J/(mol•K)	Cp J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
135.229	.1266E+02	.73591E+03	.15454	2.111954	2.25337	13.4	187.1	133.642	88.57	117.30	.38330E-06	1727	2.03955
140.000	.1258E+02	.73144E+03	.15019	2.040315	2.18121	571.6	746.4	137.704	87.98	117.00	.90960E-06	1703	2.03186
150.000	.1242E+02	.72210E+03	.14199	1.900471	2.03776	1737.3	1914.4	145.759	86.90	116.53	.45569E-05	1653	2.01577
160.000	.1226E+02	.71278E+03	.13486	1.772839	1.90353	2899.6	3079.0	153.272	86.10	116.32	.18211E-04	1603	1.99972
170.000	.1210E+02	.70347E+03	.12860	1.655682	1.77722	4061.4	4243.2	160.325	85.62	116.42	.60561E-04	1554	1.98370
180.000	.1194E+02	.69414E+03	.12309	1.547591	1.65783	5225.8	5410.0	166.990	85.48	116.85	.17309E-03	1505	1.96768
190.000	.1178E+02	.68479E+03	.11820	1.447410	1.54457	6395.9	6582.6	173.326	85.67	117.61	.43605E-03	1456	1.95166
200.000	.1162E+02	.67540E+03	.11386	1.354176	1.43681	7574.7	7764.1	179.385	86.16	118.69	.98773E-03	1406	1.93562
210.000	.1146E+02	.66594E+03	.10997	1.267081	1.33404	8765.4	8957.5	185.208	86.95	120.07	.20443E-02	1357	1.91951
220.000	.1129E+02	.65639E+03	.10650	1.185438	1.23588	9971.0	10165.8	190.831	87.99	121.73	.39169E-02	1307	1.90333
230.000	.1113E+02	.64674E+03	.10339	1.108658	1.14199	11194.1	11391.9	196.284	89.24	123.64	.70223E-02	1257	1.88704
240.000	.1096E+02	.63697E+03	.10060	1.036233	1.05211	12437.5	12638.3	201.591	90.69	125.78	.11885E-01	1207	1.87061
250.000	.1079E+02	.62704E+03	.09811	.967721	.96603	13703.5	13907.4	206.772	92.30	128.13	.19130E-01	1158	1.85399
260.000	.1061E+02	.61692E+03	.09588	.902733	.88358	14994.1	15201.4	211.846	94.04	130.66	.29465E-01	1108	1.83715
270.000	.1044E+02	.60659E+03	.09390	.840924	.80462	16311.3	16522.1	216.828	95.89	133.38	.43652E-01	1057	1.82005
280.000	.1025E+02	.59601E+03	.09216	.781985	.72903	17656.6	17871.2	221.730	97.83	136.26	.62474E-01	1007	1.80263
290.000	.1007E+02	.58512E+03	.09064	.725638	.65671	19031.7	19250.3	226.565	99.85	139.32	.86695E-01	957	1.78482
300.000	.9873E+01	.57389E+03	.08933	.671626	.58757	20438.1	20661.0	231.342	101.92	142.57	.11702E+00	906	1.76655
310.000	.9673E+01	.56224E+03	.08824	.619711	.52155	21877.5	22105.0	236.073	104.05	146.02	.15404E+00	855	1.74774
320.000	.9464E+01	.55009E+03	.08737	.569662	.45857	23351.7	23584.2	240.766	106.20	149.70	.19821E+00	803	1.72826
330.000	.9245E+01	.53735E+03	.08673	.521252	.39855	24863.0	25101.0	245.432	108.37	153.65	.24984E+00	751	1.70799
340.000	.9013E+01	.52389E+03	.08634	.474241	.34142	26414.4	26658.5	250.082	110.52	157.95	.30904E+00	698	1.68673
350.000	.8766E+01	.50950E+03	.08624	.428361	.28709	28009.7	28260.7	254.728	112.61	162.70	.37575E+00	644	1.66423
360.000	.8498E+01	.49394E+03	.08649	.383283	.23544	29654.5	29913.4	259.385	114.60	168.11	.44972E+00	587	1.64011
370.000	.8203E+01	.47677E+03	.08718	.338556	.18632	31357.3	31625.5	264.077	116.41	174.61	.53052E+00	528	1.61380
380.000	.7867E+01	.45728E+03	.08851	.293448	.13947	33132.7	33412.4	268.841	117.97	183.19	.61748E+00	465	1.58429
390.000	.7466E+01	.43398E+03	.09087	.246510	.09435	35011.3	35306.0	273.757	119.18	196.70	.70950E+00	394	1.54952
392.926	.7329E+01	.42600E+03	.09188	.231987	.08131	35591.2	35891.3	275.255	119.46	202.76	.73689E+00	371	1.53773
392.926	.1055E+01	.61294E+02	.63858	.014019	.01752	46201.5	48287.7	306.804	128.59	196.76	.73689E+00	163	1.06685
400.000	.9748E+00	.56662E+02	.67857	.012139	.02223	47332.1	49588.8	310.083	126.61	174.61	.75282E+00	175	1.06168
410.000	.8965E+00	.52108E+02	.71987	.010538	.02739	48808.5	51262.5	314.217	126.40	161.98	.77222E+00	187	1.05662
420.000	.8383E+00	.48728E+02	.75148	.009466	.03168	50226.5	52850.8	318.044	127.27	156.35	.78921E+00	197	1.05288
430.000	.7919E+00	.46028E+02	.77705	.008671	.03544	51621.0	54399.1	321.688	128.62	153.66	.80428E+00	205	1.04990
440.000	.7532E+00	.43779E+02	.79841	.008047	.03883	53008.1	55928.9	325.205	130.25	152.50	.81782E+00	213	1.04742
450.000	.7200E+00	.41852E+02	.81662	.007537	.04197	54396.7	57452.1	328.628	132.04	152.26	.83004E+00	219	1.04530
460.000	.6910E+00	.40166E+02	.83239	.007110	.04489	55792.4	58976.0	331.977	133.94	152.60	.84114E+00	226	0.00000
470.000	.6653E+00	.38670E+02	.84621	.006745	.04766	57198.7	60505.5	335.266	135.90	153.34	.85126E+00	231	0.00000
480.000	.6422E+00	.37325E+02	.85843	.006428	.05029	58617.8	62043.7	338.505	137.90	154.35	.86054E+00	237	0.00000
490.000	.6212E+00	.36105E+02	.86931	.006148	.05281	60051.5	63593.2	341.700	139.92	155.56	.86906E+00	242	0.00000
500.000	.6020E+00	.34990E+02	.87907	.005900	.05523	61500.9	65155.5	344.856	141.96	156.92	.87691E+00	247	0.00000
520.000	.5680E+00	.33015E+02	.89584	.005474	.05984	64450.0	68323.2	351.068	146.03	159.91	.89088E+00	255	0.00000
540.000	.5386E+00	.31308E+02	.90971	.005120	.06421	67469.1	71553.5	357.163	150.07	163.14	.90291E+00	264	0.00000
560.000	.5128E+00	.29809E+02	.92133	.004820	.06838	70560.0	74849.8	363.157	154.05	166.49	.91335E+00	271	0.00000
580.000	.4899E+00	.28476E+02	.93118	.004561	.07240	73723.1	78213.6	369.058	157.95	169.89	.92245E+00	279	0.00000
620.000	.4507E+00	.26197E+02	.94689	.004133	.08007	80264.1	85145.3	380.613	165.47	176.68	.93749E+00	292	0.00000
660.000	.4182E+00	.24305E+02	.95874	.003790	.08737	87084.3	92345.5	391.864	172.62	183.29	.94935E+00	304	0.00000
700.000	.3905E+00	.22700E+02	.96787	.003508	.09442	94172.2	99805.4	402.836	179.37	189.66	.95875E+00	315	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 2.4 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
135.262	.1266E+02	.73596E+03	.16854	2.112126	2.25505	14.6	204.1	133.651	88.58	117.29	.35858E-06	1728	2.03964
140.000	.1259E+02	.73153E+03	.16382	2.041022	2.18342	568.7	759.4	137.684	87.99	117.00	.84527E-06	1703	2.03201
150.000	.1243E+02	.72220E+03	.15488	1.901217	2.04002	1734.2	1927.3	145.738	86.91	116.52	.42315E-05	1653	2.01593
160.000	.1226E+02	.71289E+03	.14709	1.773621	1.90583	2896.2	3091.9	153.250	86.11	116.31	.16899E-04	1604	1.99989
170.000	.1210E+02	.70358E+03	.14027	1.656498	1.77958	4057.7	4256.0	160.303	85.63	116.41	.56167E-04	1555	1.98388
180.000	.1194E+02	.69426E+03	.13426	1.548440	1.66024	5221.8	5422.7	166.967	85.49	116.84	.16045E-03	1506	1.96788
190.000	.1178E+02	.68492E+03	.12893	1.448291	1.54704	6391.5	6595.2	173.303	85.68	117.60	.40403E-03	1457	1.95188
200.000	.1162E+02	.67553E+03	.12418	1.355091	1.43933	7570.0	7776.5	179.361	86.17	118.67	.91484E-03	1407	1.93584
210.000	.1146E+02	.66609E+03	.11995	1.268030	1.33663	8760.3	8969.7	185.183	86.96	120.05	.18928E-02	1358	1.91976
220.000	.1130E+02	.65655E+03	.11616	1.186422	1.23852	9965.3	10177.8	190.806	88.00	121.71	.36255E-02	1308	1.90360
230.000	.1113E+02	.64692E+03	.11276	1.109680	1.14470	11188.0	11403.6	196.257	89.25	123.62	.64979E-02	1259	1.88733
240.000	.1096E+02	.63716E+03	.10972	1.037297	1.05489	12430.8	12649.8	201.562	90.70	125.75	.10995E-01	1209	1.87091
250.000	.1079E+02	.62724E+03	.10699	.968829	.96888	13696.2	13918.6	206.743	92.31	128.09	.17693E-01	1159	1.85433
260.000	.1062E+02	.61715E+03	.10456	.903890	.88650	14986.1	15212.1	211.815	94.05	130.62	.27246E-01	1109	1.83752
270.000	.1044E+02	.60684E+03	.10240	.842135	.80762	16302.5	16532.3	216.795	95.90	133.32	.40357E-01	1059	1.82045
280.000	.1026E+02	.59628E+03	.10049	.783256	.73211	17646.9	17880.9	221.695	97.84	136.20	.57750E-01	1009	1.80307
290.000	.1007E+02	.58543E+03	.09882	.726977	.65987	19021.0	19259.3	226.527	99.86	139.25	.80128E-01	959	1.78530
300.000	.9879E+01	.57423E+03	.09739	.673044	.59083	20426.2	20669.1	231.302	101.93	142.48	.10814E+00	908	1.76709
310.000	.9680E+01	.56262E+03	.09620	.621219	.52490	21864.2	22112.1	236.029	104.06	145.91	.14234E+00	857	1.74834
320.000	.9472E+01	.55053E+03	.09524	.571276	.46202	23336.7	23590.1	240.718	106.21	149.56	.18314E+00	806	1.72895
330.000	.9254E+01	.53785E+03	.09453	.522992	.40212	24846.0	25105.3	245.380	108.37	153.47	.23083E+00	754	1.70878
340.000	.9023E+01	.52447E+03	.09409	.476135	.34513	26394.8	26660.7	250.023	110.52	157.71	.28552E+00	701	1.68764
350.000	.8778E+01	.51019E+03	.09396	.430448	.29096	27986.8	28260.2	254.661	112.61	162.38	.34715E+00	647	1.66530
360.000	.8512E+01	.49478E+03	.09419	.385622	.23950	29627.2	29909.2	259.308	114.60	167.67	.41550E+00	591	1.64141
370.000	.8221E+01	.47783E+03	.09490	.341240	.19062	31323.9	31615.8	263.985	116.40	173.94	.49018E+00	533	1.61541
380.000	.7891E+01	.45869E+03	.09626	.296652	.14410	33089.8	33393.9	268.725	117.94	182.05	.57059E+00	471	1.58640
390.000	.7502E+01	.43604E+03	.09866	.250619	.09951	34951.3	35271.2	273.599	119.11	194.37	.65575E+00	402	1.55257
397.890	.7117E+01	.41365E+03	.10194	.211326	.06502	36531.7	36868.9	277.656	119.71	212.54	.72512E+00	339	1.51964
397.890	.1186E+01	.68913E+02	.61188	.016255	.01533	46462.1	48486.4	306.854	131.42	215.36	.72512E+00	158	1.07539
400.000	.1150E+01	.66856E+02	.62738	.015355	.01707	46839.2	48925.7	307.952	130.18	202.02	.73052E+00	162	1.07308
410.000	.1032E+01	.59978E+02	.68227	.012711	.02347	48451.1	50776.9	312.524	128.20	173.80	.75246E+00	178	1.06538
420.000	.9529E+00	.55387E+02	.72123	.011167	.02841	49937.2	52455.8	316.571	128.45	163.37	.77136E+00	190	1.06027
430.000	.8931E+00	.51909E+02	.75167	.010090	.03261	51374.7	54062.1	320.350	129.48	158.44	.78799E+00	199	1.05641
440.000	.8448E+00	.49102E+02	.77657	.009275	.03633	52792.0	55633.0	323.962	130.92	156.04	.80287E+00	208	1.05330
450.000	.8043E+00	.46750E+02	.79752	.008627	.03971	54203.3	57187.3	327.455	132.58	155.00	.81625E+00	215	1.05070
460.000	.7695E+00	.44725E+02	.81549	.008094	.04285	55616.8	58735.8	330.859	134.38	154.81	.82837E+00	222	0.00000
470.000	.7389E+00	.42951E+02	.83113	.007644	.04579	57037.5	60285.4	334.191	136.27	155.17	.83942E+00	228	0.00000
480.000	.7118E+00	.41372E+02	.84487	.007258	.04857	58468.6	61840.4	337.465	138.21	155.89	.84952E+00	234	0.00000
490.000	.6873E+00	.39951E+02	.85706	.006922	.05122	59912.4	63404.1	340.689	140.19	156.89	.85879E+00	239	0.00000
500.000	.6651E+00	.38661E+02	.86794	.006624	.05376	61370.5	64978.8	343.870	142.20	158.07	.86733E+00	244	0.00000
520.000	.6261E+00	.36393E+02	.88657	.006120	.05857	64333.8	68166.9	350.122	146.22	160.81	.88253E+00	253	0.00000
540.000	.5927E+00	.34450E+02	.90189	.005707	.06309	67364.0	71413.4	356.248	150.22	163.87	.89558E+00	262	0.00000
560.000	.5635E+00	.32755E+02	.91469	.005358	.06740	70463.9	74722.8	362.265	154.17	167.10	.90689E+00	270	0.00000
580.000	.5377E+00	.31255E+02	.92551	.005060	.07153	73634.5	78097.7	368.186	158.05	170.40	.91675E+00	277	0.00000
620.000	.4939E+00	.28706E+02	.94270	.004570	.07939	80187.3	85046.9	379.770	165.55	177.05	.93303E+00	291	0.00000
660.000	.4577E+00	.26601E+02	.95563	.004181	.08685	87016.4	92260.4	391.043	172.67	183.59	.94585E+00	303	0.00000
700.000	.4271E+00	.24823E+02	.96557	.003863	.09402	94111.2	99730.9	402.030	179.41	189.89	.95601E+00	315	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 2.6 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
135.296	.1266E+02	.73602E+03	.18252	2.112299	2.25672	15.8	221.1	133.660	88.59	117.29	.33780E-06	1728	2.03973
140.000	.1259E+02	.73162E+03	.17745	2.041729	2.18563	565.9	772.5	137.663	88.00	116.99	.79097E-06	1704	2.03216
150.000	.1243E+02	.72230E+03	.16776	1.901963	2.04227	1731.1	1940.3	145.717	86.92	116.52	.39567E-05	1654	2.01609
160.000	.1227E+02	.71299E+03	.15933	1.774403	1.90814	2892.8	3104.8	153.229	86.12	116.30	.15792E-04	1605	2.00006
170.000	.1211E+02	.70369E+03	.15194	1.657313	1.78194	4054.0	4268.8	160.281	85.64	116.40	.52456E-04	1556	1.98406
180.000	.1195E+02	.69438E+03	.14542	1.549288	1.66265	5217.8	5435.4	166.945	85.50	116.83	.14978E-03	1507	1.96808
190.000	.1179E+02	.68505E+03	.13964	1.449172	1.54950	6387.1	6607.7	173.280	85.69	117.58	.37698E-03	1458	1.95209
200.000	.1162E+02	.67567E+03	.13450	1.356004	1.44185	7565.2	7788.9	179.337	86.18	118.66	.85325E-03	1408	1.93607
210.000	.1146E+02	.66623E+03	.12991	1.268977	1.33921	8755.1	8981.9	185.159	86.97	120.03	.17647E-02	1359	1.92000
220.000	.1130E+02	.65672E+03	.12580	1.187406	1.24117	9959.7	10189.8	190.780	88.01	121.69	.33791E-02	1310	1.90386
230.000	.1113E+02	.64709E+03	.12212	1.110701	1.14740	11181.9	11415.4	196.230	89.26	123.59	.60547E-02	1260	1.88761
240.000	.1097E+02	.63735E+03	.11882	1.038359	1.05766	12424.2	12661.3	201.534	90.71	125.72	.10242E-01	1210	1.87122
250.000	.1079E+02	.62745E+03	.11587	.969935	.97172	13688.9	13929.7	206.713	92.32	128.05	.16478E-01	1160	1.85466
260.000	.1062E+02	.61737E+03	.11323	.905044	.88942	14978.1	15222.9	211.784	94.06	130.58	.25370E-01	1111	1.83789
270.000	.1044E+02	.60709E+03	.11089	.843342	.81061	16293.7	16542.6	216.762	95.91	133.27	.37572E-01	1061	1.82085
280.000	.1026E+02	.59655E+03	.10881	.784524	.73517	17637.2	17890.6	221.660	97.85	136.14	.53756E-01	1011	1.80351
290.000	.1008E+02	.58573E+03	.10700	.728312	.66302	19010.3	19268.3	226.490	99.87	139.17	.74576E-01	961	1.78579
300.000	.9885E+01	.57457E+03	.10545	.674456	.59407	20414.3	20677.4	231.262	101.94	142.39	.10063E+00	910	1.76763
310.000	.9686E+01	.56300E+03	.10414	.622720	.52824	21850.9	22119.3	235.986	104.07	145.80	.13244E+00	860	1.74895
320.000	.9479E+01	.55096E+03	.10309	.572881	.46547	23321.8	23596.1	240.671	106.22	149.42	.17040E+00	809	1.72963
330.000	.9262E+01	.53835E+03	.10231	.524720	.40568	24829.0	25109.7	245.328	108.38	153.30	.21476E+00	757	1.70955
340.000	.9033E+01	.52504E+03	.10182	.478013	.34882	26375.3	26663.2	249.965	110.53	157.49	.26563E+00	704	1.68854
350.000	.8789E+01	.51088E+03	.10165	.432513	.29480	27964.2	28260.0	254.596	112.61	162.08	.32296E+00	651	1.66636
360.000	.8527E+01	.49561E+03	.10187	.387929	.24353	29600.4	29905.3	259.232	114.59	167.24	.38655E+00	596	1.64268
370.000	.8239E+01	.47887E+03	.10258	.343877	.19488	31291.1	31606.7	263.894	116.39	173.30	.45606E+00	538	1.61699
380.000	.7915E+01	.46005E+03	.10397	.299772	.14867	33048.1	33376.6	268.613	117.92	181.00	.53093E+00	477	1.58846
390.000	.7536E+01	.43800E+03	.10640	.254554	.10455	34894.0	35239.1	273.449	119.05	192.28	.61030E+00	410	1.55547
400.000	.7052E+01	.40987E+03	.11086	.205627	.06170	36887.8	37256.5	278.555	119.64	214.49	.69271E+00	332	1.51411
402.537	.6897E+01	.40088E+03	.11263	.191800	.05076	37436.5	37813.5	279.944	119.71	225.21	.71389E+00	309	1.50107
402.537	.1329E+01	.77271E+02	.58435	.018788	.01313	46669.6	48625.3	306.803	134.36	239.74	.71389E+00	153	1.08482
410.000	.1194E+01	.69386E+02	.63891	.015511	.01911	48023.9	50201.9	310.681	130.64	192.97	.73237E+00	167	1.07593
420.000	.1082E+01	.62892E+02	.68810	.013192	.02493	49612.3	52015.2	315.052	129.86	172.95	.75338E+00	182	1.06864
430.000	.1004E+01	.58337E+02	.72458	.011714	.02965	51106.4	53697.0	319.010	130.46	164.45	.77168E+00	193	1.06356
440.000	.9430E+00	.54813E+02	.75364	.010648	.03374	52561.1	55318.2	322.737	131.65	160.25	.78794E+00	202	1.05963
450.000	.8936E+00	.51937E+02	.77768	.009824	.03740	53999.3	56909.0	326.312	133.15	158.17	.80251E+00	210	1.05644
460.000	.8518E+00	.49510E+02	.79808	.009161	.04076	55433.3	58485.7	329.778	134.85	157.30	.81568E+00	218	0.00000
470.000	.8157E+00	.47411E+02	.81567	.008611	.04389	56870.2	60057.6	333.158	136.66	157.19	.82768E+00	224	0.00000
480.000	.7839E+00	.45565E+02	.83104	.008145	.04683	58314.5	61631.2	336.471	138.54	157.58	.83861E+00	230	0.00000
490.000	.7556E+00	.43918E+02	.84461	.007742	.04961	59769.4	63210.4	339.727	140.48	158.32	.84863E+00	236	0.00000
500.000	.7300E+00	.42434E+02	.85667	.007389	.05227	61236.9	64798.3	342.935	142.44	159.30	.85786E+00	241	0.00000
520.000	.6855E+00	.39846E+02	.87722	.006797	.05729	64215.4	68008.1	349.229	146.41	161.76	.87426E+00	251	0.00000
540.000	.6477E+00	.37648E+02	.89404	.006317	.06198	67257.5	71271.6	355.387	150.38	164.63	.88833E+00	260	0.00000
560.000	.6150E+00	.35744E+02	.90805	.005915	.06643	70366.9	74594.8	361.430	154.30	167.72	.90051E+00	268	0.00000
580.000	.5861E+00	.34068E+02	.91985	.005574	.07068	73545.2	77981.1	367.371	158.16	170.92	.91112E+00	276	0.00000
620.000	.5374E+00	.31235E+02	.93855	.005018	.07873	80110.1	84948.4	378.985	165.63	177.44	.92864E+00	290	0.00000
660.000	.4974E+00	.28911E+02	.95256	.004581	.08634	86948.3	92175.5	390.279	172.73	183.89	.94240E+00	303	0.00000
700.000	.4637E+00	.26955E+02	.96331	.004225	.09362	94050.1	99656.7	401.282	179.46	190.13	.95331E+00	314	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 2.8 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
135.329	.1266E+02	.73608E+03	.19650	2.112473	2.25840	17.0	238.1	133.669	88.59	117.28	.32011E-06	1729	2.03982
140.000	.1259E+02	.73171E+03	.19108	2.042436	2.18784	563.1	785.5	137.643	88.01	116.99	.74456E-06	1705	2.03230
150.000	.1243E+02	.72239E+03	.18064	1.902708	2.04453	1728.0	1953.3	145.697	86.93	116.51	.37218E-05	1655	2.01625
160.000	.1227E+02	.71310E+03	.17156	1.775184	1.91044	2889.5	3117.7	153.208	86.13	116.30	.14845E-04	1606	2.00023
170.000	.1211E+02	.70380E+03	.16360	1.658128	1.78429	4050.4	4281.6	160.259	85.65	116.39	.49282E-04	1557	1.98425
180.000	.1195E+02	.69450E+03	.15658	1.550136	1.66506	5213.8	5448.1	166.922	85.51	116.81	.14064E-03	1508	1.96827
190.000	.1179E+02	.68518E+03	.15036	1.450052	1.55197	6382.8	6620.3	173.257	85.70	117.57	.35383E-03	1459	1.95230
200.000	.1163E+02	.67581E+03	.14482	1.356917	1.44437	7560.5	7801.3	179.313	86.19	118.64	.80054E-03	1409	1.93630
210.000	.1146E+02	.66638E+03	.13987	1.269924	1.34179	8749.9	8994.2	185.134	86.98	120.01	.16552E-02	1360	1.92025
220.000	.1130E+02	.65688E+03	.13545	1.188387	1.24381	9954.1	10201.9	190.754	88.02	121.66	.31683E-02	1311	1.90412
230.000	.1114E+02	.64727E+03	.13148	1.111721	1.15011	11175.8	11427.2	196.203	89.27	123.56	.56753E-02	1261	1.88789
240.000	.1097E+02	.63754E+03	.12793	1.039418	1.06043	12417.5	12672.8	201.506	90.72	125.69	.95980E-02	1212	1.87153
250.000	.1080E+02	.62766E+03	.12474	.971039	.97456	13681.6	13940.9	206.684	92.33	128.02	.15438E-01	1162	1.85499
260.000	.1063E+02	.61760E+03	.12190	.906195	.89233	14970.2	15233.7	211.753	94.07	130.53	.23764E-01	1112	1.83825
270.000	.1045E+02	.60733E+03	.11937	.844547	.81359	16284.9	16552.9	216.729	95.92	133.22	.35187E-01	1062	1.82125
280.000	.1027E+02	.59682E+03	.11713	.785787	.73824	17627.6	17900.3	221.625	97.86	136.08	.50335E-01	1013	1.80394
290.000	.1008E+02	.58603E+03	.11518	.729642	.66617	18999.7	19277.4	226.453	99.88	139.10	.69821E-01	963	1.78627
300.000	.9891E+01	.57490E+03	.11349	.675862	.59730	20402.5	20685.6	231.222	101.95	142.30	.94207E-01	913	1.76817
310.000	.9693E+01	.56338E+03	.11208	.624213	.53157	21837.7	22126.6	235.942	104.07	145.69	.12397E+00	862	1.74955
320.000	.9486E+01	.55139E+03	.11094	.574476	.46890	23307.0	23602.1	240.624	106.23	149.29	.15949E+00	811	1.73031
330.000	.9270E+01	.53884E+03	.11008	.526437	.40923	24812.2	25114.3	245.276	108.39	153.13	.20100E+00	760	1.71033
340.000	.9043E+01	.52561E+03	.10953	.479875	.35250	26356.1	26665.7	249.908	110.53	157.26	.24859E+00	708	1.68943
350.000	.8801E+01	.51155E+03	.10933	.434557	.29862	27941.8	28260.0	254.531	112.62	161.78	.30224E+00	654	1.66740
360.000	.8541E+01	.49642E+03	.10953	.390206	.24753	29574.0	29901.8	259.157	114.59	166.82	.36177E+00	600	1.64393
370.000	.8256E+01	.47988E+03	.11024	.346467	.19910	31259.0	31598.2	263.806	116.38	172.69	.42684E+00	543	1.61853
380.000	.7938E+01	.46138E+03	.11165	.302816	.15317	33007.5	33360.3	268.504	117.89	180.01	.49696E+00	483	1.59045
390.000	.7568E+01	.43987E+03	.11410	.258336	.10948	34839.2	35209.2	273.304	118.99	190.41	.57135E+00	418	1.55825
400.000	.7105E+01	.41297E+03	.11850	.210948	.06740	36802.0	37196.1	278.334	119.47	209.48	.64872E+00	343	1.51863
406.902	.6665E+01	.38742E+03	.12417	.173138	.03831	38314.2	38734.3	282.144	119.38	242.69	.70313E+00	279	1.48169
406.902	.1490E+01	.86592E+02	.55554	.021697	.01092	46819.8	48699.3	306.634	137.49	273.49	.70313E+00	147	1.09542
410.000	.1402E+01	.81494E+02	.58583	.019455	.01403	47474.8	49471.9	308.523	134.45	231.24	.71171E+00	155	1.08962
420.000	.1231E+01	.71577E+02	.65111	.015671	.02118	49238.2	51511.9	313.441	131.63	186.89	.73521E+00	173	1.07840
430.000	.1126E+01	.65459E+02	.69541	.013598	.02655	50811.0	53297.2	317.642	131.59	172.22	.75531E+00	186	1.07152
440.000	.1049E+01	.60988E+02	.72943	.012193	.03106	52312.8	54981.3	321.514	132.46	165.37	.77302E+00	196	1.06652
450.000	.9886E+00	.57460E+02	.75701	.011146	.03504	53783.2	56615.6	325.187	133.78	161.87	.78881E+00	205	1.06258
460.000	.9385E+00	.54548E+02	.78008	.010324	.03864	55240.9	58224.5	328.723	135.35	160.13	.80307E+00	213	0.00000
470.000	.8959E+00	.52071E+02	.79981	.009653	.04196	56696.2	59821.7	332.158	137.07	159.44	.81600E+00	220	0.00000
480.000	.8588E+00	.49918E+02	.81692	.009092	.04507	58155.3	61415.6	335.514	138.89	159.43	.82777E+00	227	0.00000
490.000	.8261E+00	.48016E+02	.83194	.008613	.04800	59622.3	63011.8	338.805	140.78	159.87	.83855E+00	233	0.00000
500.000	.7968E+00	.46315E+02	.84525	.008197	.05078	61100.1	64614.0	342.042	142.70	160.62	.84846E+00	239	0.00000
520.000	.7463E+00	.43377E+02	.86780	.007506	.05600	64094.9	67846.8	348.381	146.61	162.77	.86606E+00	249	0.00000
540.000	.7037E+00	.40904E+02	.88617	.006951	.06086	67149.4	71128.2	354.573	150.53	165.43	.88115E+00	258	0.00000
560.000	.6671E+00	.38777E+02	.90140	.006492	.06545	70268.7	74465.7	360.642	154.43	168.37	.89419E+00	267	0.00000
580.000	.6351E+00	.36915E+02	.91421	.006104	.06982	73455.2	77863.9	366.604	158.27	171.46	.90556E+00	275	0.00000
620.000	.5813E+00	.33786E+02	.93443	.005477	.07807	80032.6	84849.6	378.249	165.71	177.84	.92430E+00	289	0.00000
660.000	.5374E+00	.31234E+02	.94952	.004988	.08583	86880.0	92090.6	389.564	172.79	184.19	.93901E+00	302	0.00000
700.000	.5006E+00	.29095E+02	.96108	.004592	.09324	93989.1	99582.7	400.583	179.51	190.38	.95066E+00	314	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 3.0 MPa

Temp. K	Density mol/L	Density kg/m³	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m³/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
135.363	.1266E+02	.73614E+03	.21047	2.112647	2.26007	18.3	255.1	133.678	88.60	117.27	.30490E-06	1729	2.03991
140.000	.1259E+02	.73180E+03	.20470	2.043142	2.19005	560.3	798.6	137.623	88.02	116.98	.70448E-06	1706	2.03245
150.000	.1243E+02	.72249E+03	.19352	1.903454	2.04679	1724.9	1966.3	145.676	86.94	116.50	.35188E-05	1656	2.01641
160.000	.1227E+02	.71320E+03	.18379	1.775965	1.91275	2886.1	3130.6	153.186	86.14	116.29	.14026E-04	1606	2.00040
170.000	.1211E+02	.70392E+03	.17526	1.658942	1.78664	4046.7	4294.4	160.238	85.66	116.38	.46537E-04	1557	1.98443
180.000	.1195E+02	.69462E+03	.16773	1.550982	1.66747	5209.8	5460.8	166.900	85.52	116.80	.13274E-03	1509	1.96847
190.000	.1179E+02	.68531E+03	.16107	1.450931	1.55443	6378.4	6632.9	173.234	85.71	117.55	.33381E-03	1460	1.95251
200.000	.1163E+02	.67595E+03	.15513	1.357829	1.44689	7555.8	7813.7	179.289	86.20	118.62	.75494E-03	1411	1.93652
210.000	.1147E+02	.66653E+03	.14983	1.270869	1.34437	8744.8	9006.4	185.109	86.99	120.00	.15603E-02	1361	1.92049
220.000	.1130E+02	.65704E+03	.14509	1.189368	1.24645	9948.5	10213.9	190.728	88.03	121.64	.29858E-02	1312	1.90438
230.000	.1114E+02	.64744E+03	.14084	1.112739	1.15281	11169.7	11439.0	196.176	89.28	123.54	.53469E-02	1262	1.88818
240.000	.1097E+02	.63772E+03	.13702	1.040476	1.06320	12410.9	12684.3	201.478	90.73	125.66	.90404E-02	1213	1.87184
250.000	.1080E+02	.62786E+03	.13361	.972140	.97739	13674.4	13952.1	206.654	92.34	127.98	.14538E-01	1163	1.85533
260.000	.1063E+02	.61782E+03	.13056	.907344	.89523	14962.2	15244.5	211.722	94.08	130.49	.22374E-01	1114	1.83861
270.000	.1045E+02	.60758E+03	.12784	.845748	.81657	16276.2	16563.2	216.697	95.93	133.17	.33122E-01	1064	1.82164
280.000	.1027E+02	.59710E+03	.12544	.787047	.74130	17618.0	17910.1	221.591	97.87	136.02	.47374E-01	1014	1.80438
290.000	.1009E+02	.58633E+03	.12334	.730968	.66931	18989.1	19286.5	226.416	99.89	139.03	.65705E-01	965	1.78675
300.000	.9897E+01	.57524E+03	.12153	.677262	.60053	20390.8	20693.9	231.182	101.96	142.21	.88642E-01	915	1.76870
310.000	.9699E+01	.56375E+03	.12000	.625700	.53489	21824.6	22133.9	235.900	104.08	145.58	.11664E+00	864	1.75014
320.000	.9494E+01	.55181E+03	.11877	.576063	.47232	23292.2	23608.2	240.577	106.24	149.15	.15004E+00	814	1.73098
330.000	.9279E+01	.53933E+03	.11784	.528141	.41276	24795.6	25118.9	245.225	108.40	152.96	.18908E+00	763	1.71109
340.000	.9053E+01	.52618E+03	.11723	.481723	.35615	26337.0	26668.4	249.851	110.54	157.05	.23384E+00	711	1.69031
350.000	.8812E+01	.51222E+03	.11698	.436581	.30243	27919.8	28260.2	254.466	112.62	161.49	.28430E+00	658	1.66844
360.000	.8554E+01	.49722E+03	.11716	.392454	.25150	29547.9	29898.6	259.083	114.59	166.42	.34030E+00	604	1.64516
370.000	.8273E+01	.48088E+03	.11787	.349014	.20328	31227.5	31590.2	263.719	116.37	172.10	.40153E+00	548	1.62005
380.000	.7960E+01	.46266E+03	.11929	.305789	.15762	32968.0	33344.9	268.397	117.87	179.08	.46754E+00	489	1.59239
390.000	.7599E+01	.44166E+03	.12176	.261982	.11431	34786.5	35181.3	273.165	118.94	188.71	.53762E+00	425	1.56090
400.000	.7154E+01	.41582E+03	.12609	.215904	.07289	36722.4	37141.7	278.128	119.33	205.32	.61060E+00	354	1.52279
410.000	.6509E+01	.37831E+03	.13521	.161819	.03184	38919.3	39380.2	283.659	118.68	255.59	.68456E+00	261	1.46867
411.012	.6416E+01	.37290E+03	.13683	.155060	.02749	39175.1	39642.7	284.289	118.57	268.85	.69277E+00	249	1.46099
411.012	.1673E+01	.97225E+02	.52482	.025104	.00871	46904.2	48697.7	306.320	140.96	323.75	.69277E+00	141	1.10760
420.000	.1412E+01	.82058E+02	.60852	.018844	.01707	48791.0	50916.0	311.660	133.96	209.39	.71673E+00	163	1.09026
430.000	.1264E+01	.73493E+02	.66364	.015821	.02328	50480.5	52853.1	316.219	132.92	182.66	.73882E+00	178	1.08056
440.000	.1165E+01	.67731E+02	.70373	.013946	.02829	52043.6	54618.1	320.278	133.37	171.70	.75807E+00	190	1.07408
450.000	.1090E+01	.63375E+02	.73538	.012612	.03261	53553.3	56304.8	324.068	134.46	166.22	.77516E+00	200	1.06919
460.000	.1030E+01	.59874E+02	.76145	.011592	.03648	55038.8	57951.1	327.686	135.88	163.36	.79050E+00	209	0.00000
470.000	.9798E+00	.56951E+02	.78350	.010777	.04001	56515.0	59576.8	331.183	137.51	161.96	.80439E+00	217	0.00000
480.000	.9367E+00	.54446E+02	.80249	.010105	.04329	57990.6	61193.3	334.586	139.25	161.46	.81700E+00	224	0.00000
490.000	.8990E+00	.52256E+02	.81905	.009537	.04637	59471.0	62807.9	337.915	141.08	161.55	.82855E+00	230	0.00000
500.000	.8656E+00	.50313E+02	.83367	.009049	.04928	60959.8	64425.5	341.183	142.97	162.04	.83914E+00	236	0.00000
520.000	.8084E+00	.46990E+02	.85829	.008248	.05471	63972.0	67682.9	347.571	146.81	163.83	.85794E+00	247	0.00000
540.000	.7608E+00	.44221E+02	.87826	.007611	.05975	67039.8	70983.0	353.798	150.70	166.26	.87403E+00	256	0.00000
560.000	.7201E+00	.41855E+02	.89475	.007089	.06448	70169.5	74335.5	359.894	154.56	169.04	.88795E+00	265	0.00000
580.000	.6847E+00	.39797E+02	.90858	.006650	.06897	73364.4	77745.9	365.877	158.38	172.02	.90006E+00	273	0.00000
620.000	.6255E+00	.36359E+02	.93033	.005947	.07741	79954.7	84750.6	377.554	165.79	178.24	.92001E+00	288	0.00000
660.000	.5776E+00	.33571E+02	.94652	.005403	.08533	86811.6	92005.8	388.891	172.86	184.50	.93566E+00	301	0.00000
700.000	.5375E+00	.31245E+02	.95889	.004966	.09286	93928.0	99508.9	399.927	179.55	190.62	.94806E+00	313	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 3.2 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
135.396	.1267E+02	.73619E+03	.22443	2.112821	2.26175	19.5	272.1	133.686	88.60	117.26	.29170E-06	1730	2.04000
140.000	.1259E+02	.73190E+03	.21832	2.043849	2.19226	557.5	811.6	137.603	88.03	116.97	.66952E-06	1706	2.03260
150.000	.1243E+02	.72259E+03	.20639	1.904198	2.04904	1721.9	1979.3	145.655	86.95	116.49	.33417E-05	1656	2.01656
160.000	.1227E+02	.71330E+03	.19601	1.776745	1.91505	2882.7	3143.5	153.165	86.15	116.28	.13311E-04	1607	2.00057
170.000	.1211E+02	.70403E+03	.18691	1.659756	1.78900	4043.0	4307.2	160.216	85.67	116.37	.44141E-04	1558	1.98461
180.000	.1195E+02	.69474E+03	.17889	1.551828	1.66987	5205.8	5473.5	166.878	85.53	116.79	.12585E-03	1510	1.96866
190.000	.1179E+02	.68544E+03	.17177	1.451809	1.55689	6374.1	6645.5	173.211	85.72	117.54	.31632E-03	1461	1.95272
200.000	.1163E+02	.67609E+03	.16544	1.358739	1.44941	7551.0	7826.1	179.266	86.21	118.61	.71511E-03	1412	1.93675
210.000	.1147E+02	.66668E+03	.15978	1.271813	1.34694	8739.7	9018.6	185.084	87.00	119.98	.14775E-02	1362	1.92073
220.000	.1131E+02	.65720E+03	.15472	1.190347	1.24908	9942.9	10225.9	190.703	88.04	121.62	.28264E-02	1313	1.90464
230.000	.1114E+02	.64761E+03	.15019	1.113755	1.15551	11163.6	11450.8	196.150	89.29	123.51	.50600E-02	1264	1.88846
240.000	.1097E+02	.63791E+03	.14612	1.041532	1.06596	12404.2	12695.8	201.450	90.74	125.63	.85531E-02	1214	1.87214
250.000	.1081E+02	.62806E+03	.14247	.973239	.98023	13667.1	13963.3	206.625	92.35	127.95	.13751E-01	1165	1.85566
260.000	.1063E+02	.61805E+03	.13921	.908490	.89814	14954.3	15255.2	211.691	94.09	130.45	.21159E-01	1115	1.83897
270.000	.1046E+02	.60782E+03	.13631	.846945	.81955	16267.6	16573.6	216.664	95.94	133.12	.31318E-01	1066	1.82204
280.000	.1028E+02	.59736E+03	.13374	.788303	.74435	17608.5	17919.9	221.556	97.88	135.96	.44786E-01	1016	1.80481
290.000	.1009E+02	.58663E+03	.13150	.732289	.67244	18978.5	19295.6	226.379	99.90	138.96	.62107E-01	967	1.78723
300.000	.9902E+01	.57557E+03	.12956	.678657	.60375	20379.1	20702.3	231.143	101.97	142.12	.83778E-01	917	1.76923
310.000	.9706E+01	.56413E+03	.12792	.627179	.53820	21811.6	22141.3	235.857	104.09	145.47	.11023E+00	867	1.75074
320.000	.9501E+01	.55224E+03	.12659	.577640	.47573	23277.6	23614.4	240.531	106.24	149.02	.14178E+00	816	1.73165
330.000	.9287E+01	.53981E+03	.12558	.529835	.41628	24779.1	25123.6	245.174	108.40	152.79	.17866E+00	765	1.71185
340.000	.9062E+01	.52674E+03	.12491	.483556	.35980	26318.2	26671.3	249.794	110.54	156.83	.22095E+00	714	1.69119
350.000	.8824E+01	.51287E+03	.12462	.438584	.30621	27897.9	28260.6	254.403	112.62	161.21	.26862E+00	662	1.66945
360.000	.8568E+01	.49801E+03	.12478	.394674	.25544	29522.3	29895.7	259.011	114.59	166.04	.32153E+00	608	1.64637
370.000	.8290E+01	.48185E+03	.12548	.351520	.20742	31196.6	31582.6	263.633	116.37	171.55	.37940E+00	552	1.62153
380.000	.7981E+01	.46392E+03	.12690	.308695	.16202	32929.5	33330.4	268.293	117.85	178.21	.44181E+00	494	1.59427
390.000	.7628E+01	.44337E+03	.12937	.265505	.11906	34735.7	35155.2	273.031	118.89	187.17	.50811E+00	432	1.56345
400.000	.7200E+01	.41847E+03	.13364	.220562	.07821	36647.9	37092.4	277.935	119.22	201.80	.57725E+00	363	1.52666
410.000	.6607E+01	.38401E+03	.14208	.169787	.03850	38771.5	39255.9	283.281	118.18	239.18	.64754E+00	279	1.47680
414.888	.6137E+01	.35669E+03	.15117	.137217	.01820	40034.5	40556.0	286.423	116.91	313.01	.68270E+00	220	1.43812
414.888	.1889E+01	.10977E+03	.49119	.029211	.00652	46905.9	48600.3	305.812	145.03	407.13	.68270E+00	135	1.12211
420.000	.1646E+01	.95679E+02	.55668	.023236	.01243	48218.3	50162.3	309.552	137.41	253.24	.69776E+00	151	1.10583
430.000	.1424E+01	.82782E+02	.62844	.018506	.01983	50102.9	52349.7	314.702	134.52	197.49	.72217E+00	170	1.09109
440.000	.1293E+01	.75182E+02	.67625	.015957	.02543	51749.2	54223.1	319.009	134.40	179.71	.74308E+00	184	1.08247
450.000	.1200E+01	.69752E+02	.71269	.014246	.03013	53307.6	55974.1	322.944	135.20	171.41	.76152E+00	195	1.07635
460.000	.1127E+01	.65529E+02	.74213	.012982	.03428	54825.8	57664.2	326.659	136.45	167.07	.77797E+00	204	0.00000
470.000	.1068E+01	.62078E+02	.76672	.011993	.03803	56325.9	59322.2	330.225	137.97	164.77	.79282E+00	213	0.00000
480.000	.1018E+01	.59164E+02	.78772	.011190	.04150	57819.9	60963.7	333.681	139.63	163.69	.80630E+00	220	0.00000
490.000	.9746E+00	.56647E+02	.80593	.010520	.04473	59315.0	62598.4	337.052	141.40	163.37	.81860E+00	227	0.00000
500.000	.9365E+00	.54435E+02	.82191	.009950	.04777	60815.9	64232.8	340.353	143.24	163.57	.82989E+00	233	0.00000
520.000	.8721E+00	.50689E+02	.84870	.009024	.05343	63846.8	67516.2	346.792	147.02	164.95	.84989E+00	244	0.00000
540.000	.8189E+00	.47600E+02	.87031	.008297	.05863	66928.5	70836.1	353.057	150.86	167.13	.86699E+00	254	0.00000
560.000	.7739E+00	.44981E+02	.88809	.007706	.06351	70069.1	74204.2	359.181	154.69	169.74	.88176E+00	263	0.00000
580.000	.7349E+00	.42715E+02	.90295	.007213	.06812	73272.8	77627.2	365.187	158.49	172.60	.89462E+00	272	0.00000
620.000	.6702E+00	.38954E+02	.92626	.006429	.07676	79876.5	84651.4	376.896	165.87	178.66	.91578E+00	287	0.00000
660.000	.6180E+00	.35922E+02	.94355	.005827	.08483	86743.1	91920.9	388.256	172.92	184.82	.93236E+00	301	0.00000
700.000	.5747E+00	.33403E+02	.95673	.005346	.09248	93867.0	99435.3	399.308	179.60	190.87	.94549E+00	313	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 3.4 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
135.429	.1267E+02	.73625E+03	.23838	2.112996	2.26343	20.7	289.1	133.695	88.61	117.26	.28017E-06	1730	2.04008
140.000	.1259E+02	.73199E+03	.23194	2.044555	2.19447	554.7	824.7	137.582	88.04	116.97	.63879E-06	1707	2.03275
150.000	.1243E+02	.72269E+03	.21926	1.904943	2.05129	1718.8	1992.2	145.635	86.96	116.49	.31859E-05	1657	2.01672
160.000	.1227E+02	.71341E+03	.20823	1.777525	1.91735	2879.4	3156.4	153.144	86.16	116.27	.12683E-04	1608	2.00074
170.000	.1211E+02	.70414E+03	.19856	1.660569	1.79135	4039.4	4320.0	160.194	85.68	116.36	.42033E-04	1559	1.98479
180.000	.1195E+02	.69486E+03	.19003	1.552674	1.67228	5201.8	5486.2	166.855	85.54	116.78	.11977E-03	1510	1.96886
190.000	.1179E+02	.68557E+03	.18247	1.452687	1.55934	6369.8	6658.0	173.188	85.73	117.53	.30093E-03	1462	1.95293
200.000	.1163E+02	.67623E+03	.17574	1.359649	1.45192	7546.3	7838.6	179.242	86.22	118.59	.68004E-03	1413	1.93697
210.000	.1147E+02	.66683E+03	.16973	1.272756	1.34951	8734.5	9030.9	185.060	87.01	119.96	.14045E-02	1364	1.92097
220.000	.1131E+02	.65736E+03	.16435	1.191325	1.25171	9937.4	10238.0	190.677	88.04	121.60	.26860E-02	1314	1.90490
230.000	.1114E+02	.64779E+03	.15953	1.114769	1.15820	11157.5	11462.6	196.123	89.30	123.49	.48073E-02	1265	1.88874
240.000	.1098E+02	.63810E+03	.15520	1.042586	1.06872	12397.6	12707.3	201.422	90.75	125.60	.81238E-02	1216	1.87245
250.000	.1081E+02	.62827E+03	.15133	.974335	.98305	13659.9	13974.5	206.596	92.36	127.91	.13058E-01	1166	1.85599
260.000	.1064E+02	.61827E+03	.14786	.909633	.90103	14946.4	15266.1	211.661	94.10	130.41	.20088E-01	1117	1.83933
270.000	.1046E+02	.60807E+03	.14477	.848140	.82252	16258.9	16583.9	216.632	95.95	133.07	.29728E-01	1068	1.82243
280.000	.1028E+02	.59763E+03	.14204	.789554	.74740	17599.0	17929.7	221.522	97.89	135.90	.42506E-01	1018	1.80524
290.000	.1010E+02	.58692E+03	.13964	.733605	.67557	18968.1	19304.8	226.342	99.91	138.89	.58936E-01	969	1.78771
300.000	.9908E+01	.57590E+03	.13757	.680046	.60696	20367.5	20710.6	231.103	101.98	142.04	.79491E-01	919	1.76976
310.000	.9712E+01	.56450E+03	.13582	.628651	.54150	21798.7	22148.8	235.814	104.10	145.37	.10457E+00	869	1.75132
320.000	.9508E+01	.55265E+03	.13440	.579209	.47913	23263.1	23620.7	240.485	106.25	148.89	.13450E+00	819	1.73231
330.000	.9295E+01	.54029E+03	.13331	.531517	.41979	24762.7	25128.4	245.123	108.41	152.63	.16947E+00	768	1.71260
340.000	.9072E+01	.52729E+03	.13258	.485374	.36342	26299.5	26674.3	249.738	110.55	156.63	.20958E+00	717	1.69205
350.000	.8835E+01	.51352E+03	.13224	.440569	.30997	27876.4	28261.2	254.340	112.63	160.94	.25479E+00	665	1.67046
360.000	.8581E+01	.49879E+03	.13237	.396868	.25936	29497.0	29893.2	258.939	114.59	165.67	.30498E+00	612	1.64757
370.000	.8306E+01	.48280E+03	.13305	.353987	.21152	31166.3	31575.6	263.549	116.36	171.02	.35989E+00	557	1.62298
380.000	.8002E+01	.46513E+03	.13447	.311539	.16636	32891.9	33316.8	268.191	117.83	177.39	.41913E+00	500	1.59611
390.000	.7656E+01	.44502E+03	.13695	.268917	.12372	34686.7	35130.8	272.901	118.85	185.75	.48210E+00	439	1.56590
400.000	.7242E+01	.42094E+03	.14116	.224970	.08337	36577.8	37047.3	277.753	119.11	198.77	.54784E+00	372	1.53028
410.000	.6689E+01	.38882E+03	.14910	.176678	.04467	38644.6	39152.9	282.956	117.83	227.97	.61485E+00	293	1.48369
418.544	.5807E+01	.33752E+03	.16825	.119060	.01040	40922.8	41508.3	288.627	113.32	404.47	.67286E+00	192	1.41144
418.544	.2158E+01	.12544E+03	.45271	.034419	.00433	46789.8	48365.2	305.010	150.26	573.41	.67286E+00	128	1.14043
420.000	.2011E+01	.11688E+03	.48418	.030641	.00673	47349.6	49040.4	306.616	144.32	393.49	.67791E+00	135	1.13039
430.000	.1616E+01	.93921E+02	.58853	.021864	.01616	49657.8	51761.9	313.027	136.53	220.34	.70528E+00	161	1.10381
440.000	.1437E+01	.83542E+02	.64661	.018296	.02247	51423.0	53788.6	317.688	135.57	190.17	.72801E+00	177	1.09195
450.000	.1319E+01	.76684E+02	.68878	.016081	.02760	53043.2	55620.3	321.804	136.01	177.69	.74786E+00	189	1.08418
460.000	.1231E+01	.71561E+02	.72205	.014509	.03205	54600.6	57362.2	325.633	137.07	171.36	.76547E+00	200	0.00000
470.000	.1161E+01	.67479E+02	.74944	.013310	.03604	56128.3	59056.9	329.278	138.45	167.94	.78131E+00	209	0.00000
480.000	.1103E+01	.64092E+02	.77260	.012353	.03969	57642.9	60726.3	332.793	140.03	166.15	.79564E+00	217	0.00000
490.000	.1053E+01	.61203E+02	.79256	.011566	.04308	59154.2	62383.1	336.209	141.74	165.35	.80872E+00	224	0.00000
500.000	.1010E+01	.58689E+02	.80998	.010903	.04626	60668.2	64035.4	339.547	143.52	165.20	.82070E+00	230	0.00000
520.000	.9373E+00	.54478E+02	.83902	.009837	.05214	63719.2	67346.8	346.041	147.24	166.14	.84189E+00	242	0.00000
540.000	.8782E+00	.51043E+02	.86232	.009011	.05752	66815.7	70687.3	352.344	151.03	168.03	.86000E+00	252	0.00000
560.000	.8285E+00	.48154E+02	.88141	.008344	.06254	69967.7	74071.6	358.498	154.83	170.46	.87564E+00	262	0.00000
580.000	.7857E+00	.45669E+02	.89732	.007792	.06728	73180.5	77507.7	364.527	158.60	173.19	.88923E+00	271	0.00000
620.000	.7152E+00	.41570E+02	.92221	.006922	.07612	79797.9	84551.8	376.269	165.95	179.08	.91159E+00	286	0.00000
660.000	.6587E+00	.38287E+02	.94061	.006260	.08434	86674.4	91836.1	387.652	172.98	185.14	.92911E+00	300	0.00000
700.000	.6120E+00	.35570E+02	.95460	.005733	.09211	93805.9	99361.8	398.721	179.65	191.12	.94296E+00	313	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 3.6 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
135.463	.1267E+02	.73631E+03	.25232	2.113171	2.26510	22.0	306.1	133.704	88.62	117.25	.27002E-06	1731	2.04017
140.000	.1260E+02	.73208E+03	.24555	2.045260	2.19668	551.9	837.7	137.562	88.05	116.96	.61159E-06	1708	2.03289
150.000	.1244E+02	.72278E+03	.23213	1.905687	2.05355	1715.7	2005.2	145.614	86.97	116.48	.30480E-05	1658	2.01688
160.000	.1228E+02	.71351E+03	.22045	1.778304	1.91965	2876.0	3169.3	153.123	86.17	116.26	.12126E-04	1609	2.00091
170.000	.1212E+02	.70425E+03	.21021	1.661382	1.79370	4035.7	4332.9	160.172	85.69	116.35	.40164E-04	1560	1.98497
180.000	.1196E+02	.69498E+03	.20118	1.553519	1.67468	5197.9	5498.9	166.833	85.55	116.77	.11439E-03	1511	1.96905
190.000	.1180E+02	.68569E+03	.19317	1.453563	1.56180	6365.5	6670.6	173.165	85.74	117.51	.28728E-03	1463	1.95313
200.000	.1164E+02	.67636E+03	.18604	1.360558	1.45444	7541.6	7851.0	179.218	86.23	118.58	.64894E-03	1414	1.93720
210.000	.1148E+02	.66698E+03	.17968	1.273698	1.35208	8729.4	9043.2	185.035	87.02	119.94	.13398E-02	1365	1.92121
220.000	.1131E+02	.65752E+03	.17398	1.192301	1.25434	9931.8	10250.0	190.651	88.05	121.58	.25614E-02	1316	1.90517
230.000	.1115E+02	.64796E+03	.16887	1.115782	1.16089	11151.5	11474.4	196.096	89.31	123.46	.45830E-02	1266	1.88902
240.000	.1098E+02	.63829E+03	.16428	1.043638	1.07148	12391.0	12718.9	201.395	90.76	125.57	.77429E-02	1217	1.87275
250.000	.1081E+02	.62847E+03	.16018	.975429	.98588	13652.7	13985.7	206.567	92.37	127.88	.12443E-01	1168	1.85632
260.000	.1064E+02	.61849E+03	.15650	.910774	.90393	14938.6	15276.9	211.630	94.11	130.36	.19138E-01	1118	1.83969
270.000	.1047E+02	.60831E+03	.15323	.849332	.82548	16250.3	16594.3	216.599	95.96	133.02	.28316E-01	1069	1.82282
280.000	.1029E+02	.59790E+03	.15033	.790802	.75044	17589.5	17939.5	221.487	97.90	135.84	.40481E-01	1020	1.80567
290.000	.1010E+02	.58722E+03	.14778	.734916	.67869	18957.6	19314.0	226.306	99.91	138.82	.56120E-01	971	1.78818
300.000	.9914E+01	.57623E+03	.14558	.681429	.61017	20355.9	20719.1	231.064	101.99	141.95	.75684E-01	921	1.77028
310.000	.9718E+01	.56486E+03	.14372	.630116	.54480	21785.8	22156.2	235.772	104.11	145.27	.99557E-01	871	1.75191
320.000	.9515E+01	.55307E+03	.14220	.580770	.48252	23248.7	23627.1	240.439	106.26	148.76	.12804E+00	821	1.73297
330.000	.9304E+01	.54076E+03	.14103	.533189	.42329	24746.4	25133.4	245.073	108.42	152.47	.16132E+00	771	1.71335
340.000	.9081E+01	.52784E+03	.14023	.487178	.36703	26281.0	26677.4	249.683	110.56	156.42	.19948E+00	720	1.69290
350.000	.8846E+01	.51416E+03	.13985	.442534	.31371	27855.0	28262.0	254.277	112.63	160.67	.24252E+00	668	1.67146
360.000	.8595E+01	.49955E+03	.13994	.399035	.26325	29472.0	29890.9	258.868	114.59	165.31	.29029E+00	616	1.64875
370.000	.8323E+01	.48374E+03	.14061	.356415	.21560	31136.5	31569.0	263.466	116.35	170.51	.34256E+00	562	1.62441
380.000	.8023E+01	.46632E+03	.14202	.314324	.17066	32855.2	33303.9	268.092	117.82	176.62	.39898E+00	505	1.59790
390.000	.7684E+01	.44661E+03	.14449	.272228	.12832	34639.4	35107.9	272.776	118.81	184.45	.45899E+00	446	1.56826
400.000	.7282E+01	.42327E+03	.14864	.229164	.08839	36511.5	37005.8	277.580	119.03	196.12	.52171E+00	381	1.53370
410.000	.6762E+01	.39303E+03	.15618	.182834	.05050	38532.3	39064.7	282.669	117.56	219.68	.58578E+00	307	1.48972
420.000	.5843E+01	.33959E+03	.17645	.122367	.01293	41040.9	41657.0	288.896	108.27	353.35	.65120E+00	205	1.41431
421.990	.5366E+01	.31192E+03	.19119	.099297	.00415	41925.6	42596.5	291.131	103.24	702.84	.66316E+00	167	1.37638
421.990	.2538E+01	.14753E+03	.40425	.041773	.00215	46458.0	47876.4	303.643	158.59	1073.64	.66316E+00	120	1.16663
430.000	.1860E+01	.10809E+03	.54146	.026303	.01220	49105.7	51041.5	311.083	139.22	260.51	.68802E+00	151	1.12016
440.000	.1602E+01	.93108E+02	.61431	.021062	.01941	51056.0	53303.3	316.285	136.92	204.36	.71282E+00	170	1.10288
450.000	.1450E+01	.84291E+02	.66349	.018156	.02502	52756.7	55239.2	320.636	136.90	185.41	.73418E+00	184	1.09281
460.000	.1342E+01	.78031E+02	.70113	.016194	.02980	54361.5	57043.1	324.601	137.72	176.36	.75298E+00	195	0.00000
470.000	.1259E+01	.73188E+02	.73162	.014740	.03403	55921.1	58780.1	328.337	138.96	171.52	.76983E+00	204	0.00000
480.000	.1191E+01	.69249E+02	.75712	.013602	.03788	57459.0	60480.7	331.917	140.44	168.86	.78504E+00	213	0.00000
490.000	.1134E+01	.65937E+02	.77893	.012679	.04143	58988.2	62161.6	335.384	142.08	167.50	.79889E+00	221	0.00000
500.000	.1085E+01	.63085E+02	.79786	.011910	.04475	60516.5	63833.4	338.761	143.82	166.96	.81157E+00	227	0.00000
520.000	.1004E+01	.58363E+02	.82925	.010688	.05085	63589.1	67174.4	345.313	147.46	167.39	.83396E+00	240	0.00000
540.000	.9386E+00	.54554E+02	.85428	.009752	.05641	66701.2	70536.7	351.657	151.20	168.98	.85308E+00	251	0.00000
560.000	.8839E+00	.51377E+02	.87472	.009005	.06158	69865.1	73937.8	357.842	154.97	171.21	.86957E+00	260	0.00000
580.000	.8372E+00	.48661E+02	.89170	.008390	.06644	73087.3	77387.4	363.894	158.71	173.80	.88389E+00	269	0.00000
620.000	.7606E+00	.44209E+02	.91817	.007427	.07547	79718.9	84452.0	375.671	166.03	179.51	.90745E+00	285	0.00000
660.000	.6996E+00	.40665E+02	.93769	.006700	.08385	86605.6	91751.2	387.077	173.04	185.46	.92589E+00	299	0.00000
700.000	.6494E+00	.37745E+02	.95249	.006125	.09175	93744.7	99288.4	398.163	179.70	191.38	.94047E+00	312	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 3.796 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	Cv J/(mol•K)	Cp J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
135.496	.1267E+02	.73636E+03	.26597	2.113344	2.26674	23.2	322.8	133.713	88.62	117.24	.26122E-06	1731	2.04026
140.000	.1260E+02	.73217E+03	.25889	2.045952	2.19884	549.2	850.5	137.542	88.06	116.96	.58782E-06	1708	2.03304
150.000	.1244E+02	.72288E+03	.24473	1.906417	2.05576	1712.7	2018.0	145.594	86.98	116.47	.29274E-05	1659	2.01703
160.000	.1228E+02	.71362E+03	.23241	1.779068	1.92191	2872.8	3182.0	153.102	86.18	116.25	.11638E-04	1610	2.00108
170.000	.1212E+02	.70436E+03	.22162	1.662178	1.79600	4032.2	4345.4	160.151	85.70	116.34	.38528E-04	1561	1.98515
180.000	.1196E+02	.69510E+03	.21209	1.554346	1.67703	5194.0	5511.4	166.811	85.56	116.75	.10968E-03	1512	1.96924
190.000	.1180E+02	.68582E+03	.20365	1.454422	1.56421	6361.2	6682.9	173.142	85.75	117.50	.27533E-03	1464	1.95334
200.000	.1164E+02	.67650E+03	.19613	1.361448	1.45690	7537.0	7863.2	179.195	86.24	118.56	.62169E-03	1415	1.93742
210.000	.1148E+02	.66712E+03	.18942	1.274620	1.35460	8724.4	9055.2	185.011	87.03	119.92	.12831E-02	1366	1.92145
220.000	.1131E+02	.65767E+03	.18341	1.193256	1.25692	9926.4	10261.9	190.626	88.06	121.55	.24523E-02	1317	1.90542
230.000	.1115E+02	.64813E+03	.17802	1.116773	1.16353	11145.6	11486.0	196.070	89.32	123.44	.43865E-02	1268	1.88929
240.000	.1098E+02	.63847E+03	.17318	1.044667	1.07418	12384.6	12730.2	201.367	90.77	125.54	.74090E-02	1218	1.87305
250.000	.1082E+02	.62867E+03	.16884	.976500	.98864	13645.7	13996.7	206.538	92.38	127.84	.11904E-01	1169	1.85664
260.000	.1064E+02	.61871E+03	.16496	.911889	.90676	14930.9	15287.5	211.600	94.12	130.32	.18305E-01	1120	1.84004
270.000	.1047E+02	.60855E+03	.16151	.850496	.82839	16241.9	16604.5	216.568	95.97	132.97	.27079E-01	1071	1.82321
280.000	.1029E+02	.59816E+03	.15844	.792022	.75341	17580.3	17949.2	221.454	97.91	135.78	.38706E-01	1022	1.80609
290.000	.1011E+02	.58751E+03	.15575	.736197	.68174	18947.5	19323.0	226.270	99.92	138.75	.53653E-01	972	1.78864
300.000	.9919E+01	.57655E+03	.15342	.682779	.61330	20344.7	20727.4	231.026	102.00	141.87	.72348E-01	923	1.77080
310.000	.9724E+01	.56522E+03	.15145	.631546	.54802	21773.3	22163.6	235.731	104.12	145.17	.95158E-01	874	1.75248
320.000	.9522E+01	.55348E+03	.14983	.582290	.48584	23234.7	23633.4	240.394	106.27	148.64	.12237E+00	824	1.73361
330.000	.9311E+01	.54122E+03	.14858	.534817	.42670	24730.6	25138.3	245.024	108.42	152.32	.15417E+00	774	1.71407
340.000	.9090E+01	.52837E+03	.14772	.488933	.37056	26263.0	26680.6	249.629	110.56	156.23	.19063E+00	723	1.69373
350.000	.8857E+01	.51479E+03	.14728	.444443	.31736	27834.4	28263.0	254.217	112.63	160.42	.23175E+00	672	1.67242
360.000	.8607E+01	.50029E+03	.14734	.401135	.26704	29447.9	29888.9	258.799	114.59	164.97	.27740E+00	620	1.64988
370.000	.8338E+01	.48464E+03	.14799	.358761	.21955	31107.7	31563.0	263.386	116.35	170.03	.32737E+00	566	1.62579
380.000	.8042E+01	.46746E+03	.14939	.317001	.17482	32820.0	33292.0	267.996	117.80	175.90	.38132E+00	510	1.59961
390.000	.7709E+01	.44811E+03	.15184	.275383	.13275	34594.4	35086.8	272.656	118.78	183.27	.43873E+00	452	1.57050
400.000	.7319E+01	.42543E+03	.15594	.233093	.09321	36449.6	36968.2	277.419	118.95	193.83	.49878E+00	389	1.53687
410.000	.6825E+01	.39671E+03	.16315	.188339	.05595	38432.9	38989.0	282.414	117.35	213.35	.56026E+00	318	1.49503
420.000	.6048E+01	.35153E+03	.17974	.134657	.02024	40748.9	41376.6	288.150	106.77	283.78	.62343E+00	231	1.43090
430.000	.2198E+01	.12777E+03	.48299	.032658	.00794	48368.8	50095.5	308.656	143.16	348.77	.67052E+00	139	1.14318
440.000	.1791E+01	.10410E+03	.57933	.024336	.01632	50643.2	52762.6	314.793	138.48	224.13	.69777E+00	162	1.11555
450.000	.1592E+01	.92554E+02	.63715	.020475	.02246	52450.3	54834.2	319.449	137.87	194.86	.72073E+00	178	1.10225
460.000	.1460E+01	.84867E+02	.67976	.018022	.02757	54111.9	56711.8	323.576	138.41	182.13	.74075E+00	190	0.00000
470.000	.1361E+01	.79121E+02	.71360	.016264	.03206	55708.0	58496.6	327.415	139.49	175.49	.75861E+00	200	0.00000
480.000	.1283E+01	.74549E+02	.74159	.014918	.03610	57271.7	60231.3	331.067	140.86	171.81	.77470E+00	209	0.00000
490.000	.1217E+01	.70763E+02	.76533	.013841	.03981	58820.3	61938.3	334.587	142.43	169.80	.78931E+00	217	0.00000
500.000	.1162E+01	.67539E+02	.78582	.012953	.04327	60363.8	63630.7	338.006	144.11	168.81	.80267E+00	225	0.00000
520.000	.1071E+01	.62266E+02	.81959	.011562	.04959	63459.0	67002.5	344.619	147.67	168.69	.82625E+00	238	0.00000
540.000	.9989E+00	.58063E+02	.84636	.010508	.05533	66587.3	70387.3	351.006	151.37	169.95	.84635E+00	249	0.00000
560.000	.9391E+00	.54584E+02	.86814	.009674	.06064	69763.4	73805.5	357.221	155.11	171.97	.86367E+00	259	0.00000
580.000	.8883E+00	.51629E+02	.88618	.008993	.06562	72995.2	77268.8	363.298	158.83	174.41	.87871E+00	268	0.00000
600.000	.8442E+00	.49069E+02	.90135	.008422	.07034	76287.1	80783.6	369.255	162.50	177.10	.89187E+00	276	0.00000
620.000	.8055E+00	.46816E+02	.91423	.007934	.07485	79641.0	84353.9	375.109	166.11	179.94	.90344E+00	284	0.00000
640.000	.7710E+00	.44812E+02	.92529	.007512	.07919	83058.0	87981.7	380.867	169.65	182.85	.91368E+00	292	0.00000
660.000	.7400E+00	.43009E+02	.93485	.007141	.08337	86537.9	91668.0	386.538	173.10	185.78	.92277E+00	299	0.00000
680.000	.7119E+00	.41376E+02	.94317	.006811	.08744	90080.5	95413.0	392.128	176.47	188.72	.93085E+00	305	0.00000
700.000	.6862E+00	.39886E+02	.95046	.006517	.09140	93684.8	99216.6	397.641	179.75	191.63	.93806E+00	312	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 4.0 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	Cv J/(mol•K)	Cp J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
135.530	.1267E+02	.73642E+03	.28017	2.113524	2.26845	24.4	340.1	133.722	88.63	117.23	.25307E-06	1732	2.04035
140.000	.1260E+02	.73226E+03	.27276	2.046671	2.20109	546.3	863.8	137.522	88.07	116.95	.56566E-06	1709	2.03319
150.000	.1244E+02	.72298E+03	.25785	1.907175	2.05805	1709.6	2031.2	145.573	86.99	116.47	.28149E-05	1659	2.01719
160.000	.1228E+02	.71372E+03	.24487	1.779862	1.92425	2869.4	3195.1	153.081	86.19	116.25	.11184E-04	1610	2.00125
170.000	.1212E+02	.70447E+03	.23349	1.663006	1.79840	4028.5	4358.5	160.129	85.71	116.33	.37001E-04	1562	1.98533
180.000	.1196E+02	.69522E+03	.22345	1.555206	1.67948	5189.9	5524.4	166.788	85.57	116.74	.10528E-03	1513	1.96944
190.000	.1180E+02	.68595E+03	.21455	1.455314	1.56671	6356.8	6695.8	173.119	85.76	117.48	.26416E-03	1465	1.95355
200.000	.1164E+02	.67664E+03	.20663	1.362373	1.45945	7532.3	7875.9	179.170	86.25	118.54	.59624E-03	1416	1.93764
210.000	.1148E+02	.66727E+03	.19955	1.275578	1.35722	8719.3	9067.7	184.986	87.04	119.90	.12301E-02	1367	1.92170
220.000	.1132E+02	.65784E+03	.19322	1.194249	1.25960	9920.7	10274.2	190.600	88.07	121.53	.23502E-02	1318	1.90568
230.000	.1115E+02	.64830E+03	.18753	1.117803	1.16627	11139.5	11498.1	196.043	89.33	123.41	.42028E-02	1269	1.88958
240.000	.1099E+02	.63866E+03	.18243	1.045736	1.07698	12377.9	12742.0	201.339	90.78	125.51	.70969E-02	1220	1.87335
250.000	.1082E+02	.62888E+03	.17786	.977611	.99151	13638.4	14008.1	206.509	92.39	127.81	.11400E-01	1171	1.85698
260.000	.1065E+02	.61893E+03	.17377	.913047	.90970	14922.9	15298.6	211.569	94.13	130.28	.17526E-01	1122	1.84041
270.000	.1047E+02	.60879E+03	.17012	.851705	.83140	16233.2	16615.1	216.535	95.98	132.92	.25922E-01	1073	1.82360
280.000	.1030E+02	.59843E+03	.16688	.793287	.75650	17570.7	17959.3	221.419	97.92	135.72	.37046E-01	1023	1.80653
290.000	.1011E+02	.58781E+03	.16404	.737526	.68491	18936.9	19332.4	226.233	99.93	138.68	.51344E-01	974	1.78912
300.000	.9925E+01	.57688E+03	.16158	.684179	.61655	20333.0	20736.0	230.986	102.01	141.79	.69226E-01	925	1.77133
310.000	.9731E+01	.56559E+03	.15948	.633027	.55136	21760.3	22171.4	235.688	104.13	145.06	.91043E-01	876	1.75307
320.000	.9529E+01	.55389E+03	.15776	.583865	.48927	23220.2	23640.0	240.348	106.28	148.52	.11707E+00	826	1.73427
330.000	.9320E+01	.54170E+03	.15643	.536500	.43024	24714.3	25143.5	244.973	108.43	152.16	.14748E+00	777	1.71482
340.000	.9100E+01	.52892E+03	.15549	.490746	.37421	26244.5	26684.1	249.573	110.57	156.03	.18235E+00	726	1.69459
350.000	.8868E+01	.51542E+03	.15501	.446411	.32113	27813.1	28264.2	254.155	112.64	160.16	.22168E+00	675	1.67341
360.000	.8620E+01	.50105E+03	.15502	.403296	.27096	29423.1	29887.1	258.728	114.59	164.62	.26535E+00	623	1.65105
370.000	.8354E+01	.48556E+03	.15564	.361167	.22364	31078.3	31557.2	263.304	116.34	169.55	.31315E+00	570	1.62719
380.000	.8062E+01	.46861E+03	.15703	.319733	.17911	32784.2	33280.3	267.899	117.79	175.19	.36478E+00	516	1.60135
390.000	.7735E+01	.44962E+03	.15947	.278579	.13730	34549.0	35066.1	272.535	118.74	182.12	.41976E+00	458	1.57275
400.000	.7356E+01	.42756E+03	.16350	.237016	.09811	36388.2	36932.0	277.259	118.88	191.70	.47732E+00	397	1.54001
410.000	.6885E+01	.40019E+03	.17042	.193638	.06141	38338.1	38919.1	282.171	117.17	208.02	.53634E+00	330	1.50005
420.000	.6197E+01	.36023E+03	.18482	.144234	.02690	40530.9	41176.4	287.594	105.96	251.44	.59730E+00	252	1.44308
430.000	.2891E+01	.16802E+03	.38704	.045608	.00292	46986.4	48370.2	304.452	151.34	781.15	.65119E+00	122	1.19136
440.000	.2031E+01	.11807E+03	.53828	.028598	.01302	50134.5	52103.7	313.052	140.43	255.67	.68188E+00	153	1.13178
450.000	.1759E+01	.10223E+03	.60785	.023262	.01977	52098.4	54372.7	318.152	138.97	207.48	.70667E+00	171	1.11338
460.000	.1593E+01	.92595E+02	.65651	.020142	.02525	53833.8	56344.8	322.487	139.17	189.27	.72802E+00	185	0.00000
470.000	.1474E+01	.85698E+02	.69425	.017996	.03000	55474.5	58187.4	326.450	140.06	180.21	.74696E+00	196	0.00000
480.000	.1382E+01	.80350E+02	.72503	.016391	.03425	57068.6	59962.2	330.187	141.32	175.21	.76397E+00	206	0.00000
490.000	.1308E+01	.75998E+02	.75090	.015130	.03814	58639.6	61698.9	333.768	142.80	172.40	.77940E+00	214	0.00000
500.000	.1245E+01	.72340E+02	.77310	.014103	.04173	60200.5	63414.5	337.235	144.42	170.89	.79347E+00	222	0.00000
520.000	.1143E+01	.66435E+02	.80944	.012513	.04829	63321.0	66820.6	343.914	147.90	170.11	.81828E+00	235	0.00000
540.000	.1063E+01	.61788E+02	.83808	.011326	.05421	66466.9	70229.8	350.347	151.55	171.00	.83940E+00	247	0.00000
560.000	.9974E+00	.57976E+02	.86128	.010394	.05967	69656.3	73666.6	356.597	155.25	172.78	.85758E+00	257	0.00000
580.000	.9421E+00	.54758E+02	.88045	.009638	.06478	72898.6	77144.5	362.699	158.94	175.07	.87337E+00	267	0.00000
600.000	.8944E+00	.51984E+02	.89652	.009009	.06961	76198.8	80671.3	368.677	162.60	177.65	.88717E+00	275	0.00000
620.000	.8525E+00	.49554E+02	.91015	.008474	.07421	79559.7	84251.5	374.546	166.20	180.40	.89930E+00	283	0.00000
640.000	.8154E+00	.47397E+02	.92183	.008012	.07863	82982.4	87887.7	380.318	169.72	183.24	.91004E+00	291	0.00000
660.000	.7822E+00	.45463E+02	.93192	.007608	.08289	86467.4	91581.3	386.001	173.16	186.12	.91957E+00	298	0.00000
680.000	.7521E+00	.43715E+02	.94069	.007250	.08702	90014.2	95332.7	391.600	176.52	189.02	.92803E+00	305	0.00000
700.000	.7247E+00	.42122E+02	.94836	.006930	.09103	93622.3	99141.9	397.121	179.80	191.90	.93559E+00	311	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 4.2 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
135.563	.1267E+02	.73648E+03	.29408	2.113700	2.27013	25.7	357.1	133.731	88.63	117.22	.24594E-06	1732	2.04044
140.000	.1260E+02	.73235E+03	.28637	2.047377	2.20330	543.6	876.9	137.502	88.08	116.94	.54612E-06	1710	2.03333
150.000	.1244E+02	.72308E+03	.27070	1.907919	2.06030	1706.6	2044.2	145.552	87.00	116.46	.27156E-05	1660	2.01735
160.000	.1228E+02	.71383E+03	.25707	1.780640	1.92655	2866.0	3208.0	153.060	86.20	116.24	.10782E-04	1611	2.00142
170.000	.1212E+02	.70459E+03	.24513	1.663817	1.80074	4024.8	4371.3	160.107	85.72	116.32	.35653E-04	1563	1.98552
180.000	.1196E+02	.69534E+03	.23459	1.556049	1.68188	5186.0	5537.1	166.766	85.58	116.73	.10139E-03	1514	1.96964
190.000	.1180E+02	.68608E+03	.22524	1.456188	1.56916	6352.5	6708.4	173.096	85.77	117.47	.25429E-03	1466	1.95376
200.000	.1164E+02	.67678E+03	.21692	1.363278	1.46196	7527.6	7888.3	179.147	86.26	118.53	.57374E-03	1417	1.93787
210.000	.1148E+02	.66742E+03	.20948	1.276516	1.35978	8714.2	9080.0	184.961	87.05	119.88	.11833E-02	1368	1.92194
220.000	.1132E+02	.65799E+03	.20283	1.195221	1.26222	9915.2	10286.2	190.575	88.08	121.51	.22601E-02	1319	1.90594
230.000	.1116E+02	.64848E+03	.19686	1.118811	1.16896	11133.5	11509.9	196.017	89.34	123.38	.40404E-02	1270	1.88986
240.000	.1099E+02	.63884E+03	.19150	1.046782	1.07973	12371.4	12753.5	201.312	90.79	125.48	.68209E-02	1221	1.87366
250.000	.1082E+02	.62908E+03	.18669	.978699	.99433	13631.3	14019.4	206.480	92.40	127.77	.10954E-01	1172	1.85730
260.000	.1065E+02	.61915E+03	.18239	.914179	.91258	14915.2	15309.5	211.538	94.14	130.24	.16837E-01	1123	1.84076
270.000	.1048E+02	.60903E+03	.17855	.852887	.83435	16224.7	16625.5	216.503	95.99	132.88	.24899E-01	1074	1.82399
280.000	.1030E+02	.59869E+03	.17515	.794524	.75953	17561.4	17969.2	221.385	97.93	135.67	.35578E-01	1025	1.80695
290.000	.1012E+02	.58810E+03	.17216	.738824	.68802	18926.6	19341.7	226.197	99.94	138.61	.49302E-01	976	1.78959
300.000	.9930E+01	.57720E+03	.16956	.685546	.61974	20321.6	20744.6	230.947	102.02	141.71	.66464E-01	927	1.77184
310.000	.9737E+01	.56596E+03	.16735	.634472	.55463	21747.7	22179.0	235.647	104.14	144.97	.87401E-01	878	1.75365
320.000	.9536E+01	.55430E+03	.16553	.585400	.49263	23206.1	23646.5	240.303	106.28	148.40	.11237E+00	829	1.73491
330.000	.9328E+01	.54216E+03	.16411	.538140	.43370	24698.4	25148.7	244.924	108.44	152.01	.14156E+00	779	1.71555
340.000	.9109E+01	.52945E+03	.16310	.492509	.37777	26226.5	26687.6	249.518	110.57	155.84	.17502E+00	729	1.69542
350.000	.8878E+01	.51604E+03	.16256	.448324	.32482	27792.5	28265.5	254.094	112.64	159.91	.21277E+00	679	1.67437
360.000	.8633E+01	.50178E+03	.16254	.405391	.27478	29399.1	29885.6	258.659	114.59	164.29	.25468E+00	627	1.65218
370.000	.8369E+01	.48645E+03	.16313	.363493	.22762	31050.0	31551.8	263.225	116.34	169.09	.30057E+00	575	1.62854
380.000	.8081E+01	.46971E+03	.16450	.322363	.18328	32749.8	33269.6	267.805	117.77	174.53	.35015E+00	521	1.60302
390.000	.7760E+01	.45105E+03	.16691	.281633	.14170	34505.8	35047.0	272.420	118.71	181.08	.40296E+00	464	1.57490
400.000	.7390E+01	.42956E+03	.17088	.240716	.10283	36330.6	36898.9	277.108	118.81	189.82	.45831E+00	405	1.54294
410.000	.6939E+01	.40332E+03	.17756	.198490	.06659	38252.3	38857.5	281.950	117.02	203.70	.51516E+00	340	1.50457
420.000	.6313E+01	.36693E+03	.19052	.152020	.03292	40359.7	41025.0	287.157	105.44	232.74	.57409E+00	269	1.45252
430.000	.4722E+01	.27446E+03	.24878	.082587	.00314	44081.4	44970.8	296.422	154.65	875.82	.62955E+00	133	1.32626
440.000	.2335E+01	.13575E+03	.49157	.034089	.00976	49516.8	51315.2	311.050	142.77	307.97	.66598E+00	145	1.15261
450.000	.1946E+01	.11309E+03	.57696	.026462	.01714	51712.9	53871.6	316.798	140.18	223.76	.69277E+00	165	1.12598
460.000	.1736E+01	.10089E+03	.63264	.022474	.02299	53540.3	55960.0	321.389	139.97	197.67	.71553E+00	180	0.00000
470.000	.1593E+01	.92597E+02	.67465	.019855	.02801	55232.8	57869.2	325.495	140.65	185.50	.73557E+00	192	0.00000
480.000	.1486E+01	.86348E+02	.70840	.017950	.03246	56861.0	59688.2	329.325	141.78	178.93	.75350E+00	202	0.00000
490.000	.1400E+01	.81358E+02	.73650	.016479	.03651	58456.4	61457.0	332.973	143.17	175.18	.76973E+00	211	0.00000
500.000	.1329E+01	.77220E+02	.76045	.015296	.04024	60035.8	63197.2	336.489	144.73	173.07	.78451E+00	219	0.00000
520.000	.1215E+01	.70632E+02	.79941	.013491	.04702	63182.8	66639.1	343.239	148.13	171.58	.81052E+00	233	0.00000
540.000	.1127E+01	.65514E+02	.82993	.012159	.05312	66347.2	70073.4	349.719	151.73	172.08	.83263E+00	245	0.00000
560.000	.1056E+01	.61354E+02	.85455	.011124	.05873	69550.2	73529.1	356.003	155.39	173.61	.85167E+00	256	0.00000
580.000	.9955E+00	.57865E+02	.87483	.010291	.06396	72803.0	77021.8	362.131	159.06	175.73	.86818E+00	265	0.00000
600.000	.9441E+00	.54872E+02	.89180	.009600	.06889	76111.7	80560.6	368.129	162.70	178.19	.88261E+00	274	0.00000
620.000	.8991E+00	.52260E+02	.90617	.009016	.07359	79479.5	84150.8	374.015	166.28	180.85	.89529E+00	282	0.00000
640.000	.8594E+00	.49949E+02	.91846	.008513	.07808	82908.1	87795.5	379.801	169.79	183.63	.90651E+00	290	0.00000
660.000	.8238E+00	.47883E+02	.92906	.008074	.08242	86398.0	91496.3	385.494	173.23	186.46	.91646E+00	297	0.00000
680.000	.7917E+00	.46019E+02	.93827	.007687	.08661	89949.2	95254.0	391.103	176.58	189.31	.92530E+00	304	0.00000
700.000	.7626E+00	.44323E+02	.94632	.007342	.09069	93561.0	99068.8	396.632	179.85	192.16	.93319E+00	311	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 4.4 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
135.596	.1267E+02	.73653E+03	.30799	2.113878	2.27181	26.9	374.1	133.740	88.64	117.22	.23956E-06	1733	2.04053
140.000	.1260E+02	.73244E+03	.29997	2.048082	2.20551	540.8	890.0	137.482	88.09	116.94	.52845E-06	1711	2.03348
150.000	.1244E+02	.72317E+03	.28356	1.908662	2.06255	1703.5	2057.2	145.532	87.01	116.45	.26258E-05	1661	2.01751
160.000	.1228E+02	.71393E+03	.26928	1.781418	1.92885	2862.7	3220.9	153.038	86.21	116.23	.10419E-04	1612	2.00158
170.000	.1212E+02	.70470E+03	.25676	1.664627	1.80309	4021.2	4384.1	160.086	85.73	116.31	.34432E-04	1564	1.98570
180.000	.1197E+02	.69546E+03	.24571	1.556891	1.68427	5182.1	5549.8	166.744	85.59	116.72	.97871E-04	1515	1.96983
190.000	.1181E+02	.68620E+03	.23592	1.457061	1.57161	6348.3	6721.0	173.073	85.78	117.46	.24535E-03	1467	1.95397
200.000	.1165E+02	.67691E+03	.22720	1.364183	1.46446	7522.9	7900.8	179.123	86.27	118.51	.55335E-03	1418	1.93809
210.000	.1149E+02	.66757E+03	.21941	1.277453	1.36234	8709.1	9092.2	184.937	87.06	119.86	.11408E-02	1369	1.92218
220.000	.1132E+02	.65815E+03	.21243	1.196192	1.26484	9909.7	10298.3	190.550	88.09	121.49	.21783E-02	1320	1.90620
230.000	.1116E+02	.64865E+03	.20618	1.119817	1.17164	11127.5	11521.8	195.990	89.35	123.36	.38930E-02	1271	1.89014
240.000	.1099E+02	.63903E+03	.20056	1.047826	1.08247	12364.9	12765.1	201.284	90.80	125.45	.65705E-02	1222	1.87396
250.000	.1083E+02	.62928E+03	.19552	.979784	.99714	13624.2	14030.6	206.451	92.41	127.74	.10549E-01	1174	1.85763
260.000	.1066E+02	.61937E+03	.19101	.915309	.91546	14907.4	15320.3	211.508	94.15	130.20	.16212E-01	1125	1.84112
270.000	.1048E+02	.60927E+03	.18698	.854066	.83730	16216.2	16636.0	216.471	96.00	132.83	.23970E-01	1076	1.82438
280.000	.1030E+02	.59896E+03	.18341	.795757	.76255	17552.1	17979.1	221.351	97.94	135.61	.34245E-01	1027	1.80737
290.000	.1012E+02	.58839E+03	.18027	.740118	.69111	18916.4	19351.0	226.161	99.95	138.54	.47448E-01	978	1.79005
300.000	.9936E+01	.57752E+03	.17753	.686908	.62291	20310.3	20753.2	230.909	102.03	141.63	.63957E-01	929	1.77236
310.000	.9743E+01	.56632E+03	.17521	.635911	.55789	21735.1	22186.7	235.605	104.14	144.87	.84096E-01	880	1.75422
320.000	.9543E+01	.55471E+03	.17329	.586928	.49598	23192.1	23653.1	240.258	106.29	148.28	.10811E+00	831	1.73555
330.000	.9336E+01	.54262E+03	.17178	.539771	.43714	24682.7	25154.0	244.875	108.45	151.87	.13618E+00	782	1.71627
340.000	.9118E+01	.52998E+03	.17070	.494260	.38133	26208.6	26691.2	249.465	110.58	155.65	.16837E+00	732	1.69625
350.000	.8889E+01	.51666E+03	.17010	.450219	.32849	27772.0	28267.0	254.034	112.65	159.67	.20467E+00	682	1.67532
360.000	.8645E+01	.50251E+03	.17003	.407463	.27858	29375.5	29884.4	258.592	114.59	163.98	.24499E+00	631	1.65329
370.000	.8384E+01	.48732E+03	.17059	.365787	.23157	31022.1	31546.9	263.147	116.34	168.66	.28914E+00	579	1.62987
380.000	.8100E+01	.47079E+03	.17193	.324947	.18741	32716.2	33259.4	267.713	117.76	173.91	.33686E+00	526	1.60465
390.000	.7784E+01	.45244E+03	.17432	.284614	.14605	34463.8	35029.1	272.308	118.69	180.11	.38771E+00	470	1.57697
400.000	.7423E+01	.43146E+03	.17823	.244287	.10746	36275.3	36868.0	276.964	118.76	188.12	.44104E+00	412	1.54574
410.000	.6989E+01	.40621E+03	.18469	.203059	.07162	38172.1	38801.7	281.744	116.89	200.04	.49590E+00	350	1.50876
420.000	.6409E+01	.37253E+03	.19659	.158812	.03859	40214.5	40901.0	286.787	105.07	220.05	.55295E+00	284	1.46044
430.000	.5329E+01	.30976E+03	.23093	.103005	.00937	43232.4	44058.0	294.207	151.07	446.17	.60760E+00	166	1.37345
440.000	.2760E+01	.16045E+03	.43569	.041824	.00669	48705.7	50299.6	308.562	145.60	405.17	.64961E+00	136	1.18219
450.000	.2163E+01	.12574E+03	.54359	.030268	.01455	51276.7	53310.5	315.334	141.50	245.64	.67876E+00	158	1.14079
460.000	.1893E+01	.11004E+03	.60765	.025103	.02076	53223.0	55547.0	320.251	140.81	207.82	.70302E+00	175	0.00000
470.000	.1720E+01	.10000E+03	.65443	.021897	.02603	54977.1	57534.5	324.526	141.26	191.57	.72420E+00	187	0.00000
480.000	.1595E+01	.92685E+02	.69139	.019634	.03069	56644.2	59403.5	328.461	142.25	183.06	.74307E+00	198	0.00000
490.000	.1496E+01	.86961E+02	.72186	.017920	.03490	58266.7	61207.6	332.182	143.56	178.21	.76010E+00	208	0.00000
500.000	.1416E+01	.82283E+02	.74764	.016561	.03877	59866.3	62974.5	335.752	145.05	175.41	.77559E+00	216	0.00000
520.000	.1289E+01	.74942E+02	.78930	.014514	.04577	63041.9	66454.5	342.576	148.37	173.13	.80281E+00	231	0.00000
540.000	.1193E+01	.69318E+02	.82174	.013025	.05205	66225.7	69915.2	349.107	151.91	173.20	.82592E+00	243	0.00000
560.000	.1115E+01	.64787E+02	.84781	.011879	.05780	69442.9	73390.4	355.426	155.53	174.47	.84580E+00	254	0.00000
580.000	.1050E+01	.61012E+02	.86922	.010962	.06315	72706.6	76898.3	361.581	159.18	176.41	.86303E+00	264	0.00000
600.000	.9943E+00	.57790E+02	.88709	.010206	.06818	76024.0	80449.4	367.600	162.79	178.75	.87809E+00	273	0.00000
620.000	.9461E+00	.54990E+02	.90220	.009570	.07297	79398.9	84049.7	373.503	166.36	181.32	.89131E+00	282	0.00000
640.000	.9036E+00	.52520E+02	.91511	.009024	.07755	82833.5	87703.0	379.302	169.86	184.02	.90301E+00	289	0.00000
660.000	.8657E+00	.50317E+02	.92623	.008550	.08195	86328.5	91411.2	385.006	173.29	186.80	.91339E+00	297	0.00000
680.000	.8315E+00	.48333E+02	.93588	.008132	.08621	89884.0	95175.3	390.625	176.63	189.61	.92260E+00	304	0.00000
700.000	.8006E+00	.46533E+02	.94431	.007761	.09034	93499.7	98995.7	396.162	179.90	192.42	.93083E+00	310	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 4.6 MPa

Temp. K	Density mol/L	Density kg/m^3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m^3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
135.630	.1267E+02	.73659E+03	.32188	2.114056	2.27348	28.1	391.1	133.749	88.65	117.21	.23382E-06	1733	2.04061
140.000	.1260E+02	.73253E+03	.31356	2.048787	2.20771	538.0	903.0	137.461	88.10	116.93	.51241E-06	1711	2.03362
150.000	.1244E+02	.72327E+03	.29641	1.909404	2.06480	1700.5	2070.2	145.511	87.02	116.45	.25442E-05	1662	2.01766
160.000	.1228E+02	.71403E+03	.28148	1.782196	1.93114	2859.4	3233.9	153.017	86.22	116.22	.10089E-04	1613	2.00175
170.000	.1213E+02	.70481E+03	.26839	1.665437	1.80543	4017.6	4397.0	160.064	85.74	116.30	.33322E-04	1564	1.98588
180.000	.1197E+02	.69558E+03	.25684	1.557733	1.68667	5178.1	5562.5	166.722	85.60	116.71	.94667E-04	1516	1.97002
190.000	.1181E+02	.68633E+03	.24660	1.457934	1.57406	6344.0	6733.6	173.050	85.79	117.44	.23721E-03	1467	1.95417
200.000	.1165E+02	.67705E+03	.23748	1.365087	1.46697	7518.3	7913.2	179.099	86.28	118.50	.53478E-03	1419	1.93831
210.000	.1149E+02	.66771E+03	.22933	1.278389	1.36490	8704.1	9104.5	184.912	87.07	119.85	.11022E-02	1370	1.92241
220.000	.1133E+02	.65831E+03	.22204	1.197162	1.26746	9904.2	10310.4	190.524	88.10	121.47	.21038E-02	1321	1.90646
230.000	.1116E+02	.64882E+03	.21549	1.120822	1.17432	11121.5	11533.6	195.964	89.36	123.33	.37588E-02	1273	1.89041
240.000	.1100E+02	.63921E+03	.20961	1.048869	1.08521	12358.4	12776.7	201.256	90.81	125.42	.63423E-02	1224	1.87426
250.000	.1083E+02	.62948E+03	.20434	.980867	.99994	13617.2	14041.9	206.422	92.42	127.70	.10181E-01	1175	1.85795
260.000	.1066E+02	.61959E+03	.19962	.916437	.91833	14899.7	15331.2	211.478	94.16	130.16	.15642E-01	1126	1.84147
270.000	.1049E+02	.60951E+03	.19540	.855242	.84024	16207.8	16646.4	216.439	96.01	132.78	.23123E-01	1077	1.82476
280.000	.1031E+02	.59922E+03	.19166	.796987	.76556	17542.8	17989.0	221.317	97.95	135.55	.33030E-01	1029	1.80780
290.000	.1013E+02	.58868E+03	.18837	.741407	.69420	18906.2	19360.4	226.125	99.96	138.48	.45758E-01	980	1.79052
300.000	.9942E+01	.57784E+03	.18550	.688264	.62608	20299.1	20761.8	230.871	102.03	141.55	.61672E-01	931	1.77287
310.000	.9749E+01	.56667E+03	.18306	.637344	.56114	21722.6	22194.5	235.564	104.15	144.77	.81082E-01	883	1.75479
320.000	.9550E+01	.55511E+03	.18103	.588447	.49932	23178.2	23659.8	240.213	106.30	148.16	.10423E+00	834	1.73619
330.000	.9343E+01	.54308E+03	.17943	.541391	.44058	24667.0	25159.4	244.827	108.45	151.72	.13128E+00	785	1.71699
340.000	.9127E+01	.53050E+03	.17829	.495999	.38486	26191.0	26695.0	249.411	110.58	155.47	.16230E+00	735	1.69706
350.000	.8899E+01	.51726E+03	.17762	.452098	.33214	27751.8	28268.7	253.975	112.65	159.44	.19729E+00	685	1.67626
360.000	.8658E+01	.50322E+03	.17751	.409513	.28236	29352.1	29883.4	258.525	114.59	163.67	.23615E+00	635	1.65439
370.000	.8399E+01	.48818E+03	.17803	.368051	.23549	30994.6	31542.3	263.071	116.33	168.24	.27872E+00	583	1.63118
380.000	.8118E+01	.47185E+03	.17935	.327487	.19150	32683.2	33249.8	267.623	117.75	173.31	.32474E+00	530	1.60625
390.000	.7807E+01	.45379E+03	.18170	.287526	.15034	34422.9	35012.1	272.199	118.66	179.19	.37380E+00	476	1.57899
400.000	.7454E+01	.43328E+03	.18555	.247740	.11201	36222.1	36839.1	276.824	118.71	186.57	.42529E+00	419	1.54843
410.000	.7035E+01	.40891E+03	.19181	.207390	.07652	38096.9	38750.7	281.550	116.78	196.89	.47833E+00	359	1.51268
420.000	.6493E+01	.37738E+03	.20289	.164905	.04399	40087.3	40795.8	286.463	104.78	210.74	.53363E+00	297	1.46732
430.000	.5613E+01	.32623E+03	.22924	.115380	.01536	42831.3	43650.9	293.176	149.63	353.22	.58714E+00	190	1.39588
440.000	.3385E+01	.19677E+03	.37143	.053421	.00479	47618.3	48977.2	305.407	148.27	541.58	.63263E+00	132	1.22672
450.000	.2423E+01	.14081E+03	.50749	.034877	.01210	50776.3	52675.1	313.727	142.93	275.50	.66462E+00	152	1.15863
460.000	.2068E+01	.12022E+03	.58150	.028086	.01860	52878.2	55102.3	319.064	141.71	220.15	.69049E+00	170	0.00000
470.000	.1858E+01	.10799E+03	.63360	.024144	.02411	54706.2	57182.2	323.538	141.90	198.55	.71285E+00	183	0.00000
480.000	.1710E+01	.99395E+02	.67402	.021454	.02895	56417.6	59107.6	327.593	142.74	187.65	.73268E+00	195	0.00000
490.000	.1597E+01	.92827E+02	.70698	.019459	.03331	58070.3	60950.7	331.393	143.95	181.52	.75053E+00	204	0.00000
500.000	.1506E+01	.87541E+02	.73468	.017900	.03732	59692.0	62746.3	335.021	145.37	177.93	.76673E+00	213	0.00000
520.000	.1366E+01	.79372E+02	.77913	.015586	.04454	62898.2	66266.8	341.925	148.60	174.77	.79515E+00	228	0.00000
540.000	.1259E+01	.73200E+02	.81353	.013925	.05099	66102.4	69755.0	348.508	152.09	174.36	.81926E+00	241	0.00000
560.000	.1175E+01	.68275E+02	.84106	.012659	.05688	69334.4	73250.4	354.864	155.68	175.35	.83997E+00	253	0.00000
580.000	.1105E+01	.64200E+02	.86361	.011652	.06235	72609.4	76774.0	361.046	159.29	177.11	.85793E+00	263	0.00000
600.000	.1045E+01	.60739E+02	.88239	.010828	.06749	75935.7	80337.7	367.087	162.89	179.31	.87360E+00	272	0.00000
620.000	.9934E+00	.57742E+02	.89825	.010136	.07236	79317.9	83948.4	373.006	166.44	181.79	.88737E+00	281	0.00000
640.000	.9481E+00	.55108E+02	.91177	.009546	.07702	82758.6	87610.4	378.819	169.93	184.43	.89955E+00	289	0.00000
660.000	.9078E+00	.52764E+02	.92342	.009034	.08149	86258.7	91326.1	384.536	173.35	187.15	.91034E+00	296	0.00000
680.000	.8716E+00	.50658E+02	.93351	.008584	.08581	89818.7	95096.7	390.164	176.69	189.92	.91993E+00	303	0.00000
700.000	.8387E+00	.48751E+02	.94232	.008186	.09000	93438.3	98922.7	395.709	179.94	192.69	.92849E+00	310	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 4.8 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
135.663	.1267E+02	.73665E+03	.33577	2.114234	2.27516	29.4	408.1	133.758	88.65	117.20	.22865E-06	1734	2.04070
140.000	.1260E+02	.73262E+03	.32716	2.049492	2.20992	535.2	916.1	137.441	88.11	116.93	.49780E-06	1712	2.03377
150.000	.1245E+02	.72337E+03	.30925	1.910147	2.06705	1697.5	2083.2	145.490	87.03	116.44	.24698E-05	1663	2.01782
160.000	.1229E+02	.71414E+03	.29367	1.782972	1.93344	2856.1	3246.8	152.996	86.23	116.21	.97874E-05	1614	2.00192
170.000	.1213E+02	.70492E+03	.28001	1.666247	1.80778	4014.0	4409.8	160.042	85.75	116.29	.32308E-04	1565	1.98606
180.000	.1197E+02	.69570E+03	.26796	1.558573	1.68906	5174.2	5575.2	166.699	85.61	116.70	.91741E-04	1517	1.97021
190.000	.1181E+02	.68646E+03	.25727	1.458806	1.57650	6339.7	6746.2	173.027	85.79	117.43	.22978E-03	1468	1.95438
200.000	.1165E+02	.67718E+03	.24776	1.365990	1.46947	7513.7	7925.7	179.076	86.29	118.48	.51782E-03	1420	1.93853
210.000	.1149E+02	.66786E+03	.23925	1.279324	1.36746	8699.0	9116.8	184.888	87.08	119.83	.10668E-02	1371	1.92265
220.000	.1133E+02	.65847E+03	.23164	1.198130	1.27007	9898.8	10322.5	190.499	88.11	121.45	.20357E-02	1323	1.90671
230.000	.1117E+02	.64899E+03	.22480	1.121825	1.17699	11115.6	11545.5	195.938	89.37	123.31	.36361E-02	1274	1.89069
240.000	.1100E+02	.63940E+03	.21867	1.049910	1.08795	12351.9	12788.3	201.229	90.82	125.39	.61337E-02	1225	1.87456
250.000	.1083E+02	.62968E+03	.21316	.981948	1.00274	13610.1	14053.2	206.393	92.43	127.67	.98436E-02	1176	1.85828
260.000	.1066E+02	.61980E+03	.20823	.917562	.92120	14892.0	15342.2	211.448	94.17	130.12	.15121E-01	1128	1.84182
270.000	.1049E+02	.60975E+03	.20382	.856415	.84318	16199.4	16656.9	216.407	96.02	132.73	.22349E-01	1079	1.82515
280.000	.1031E+02	.59948E+03	.19991	.798213	.76857	17533.6	17999.0	221.284	97.96	135.50	.31919E-01	1031	1.80822
290.000	.1013E+02	.58896E+03	.19646	.742692	.69728	18896.1	19369.8	226.089	99.97	138.41	.44212E-01	982	1.79098
300.000	.9947E+01	.57816E+03	.19346	.689615	.62924	20287.9	20770.4	230.832	102.04	141.47	.59581E-01	933	1.77338
310.000	.9755E+01	.56703E+03	.19090	.638770	.56438	21710.2	22202.3	235.523	104.16	144.68	.78325E-01	885	1.75535
320.000	.9557E+01	.55551E+03	.18877	.589959	.50265	23164.3	23666.6	240.169	106.31	148.04	.10068E+00	836	1.73682
330.000	.9351E+01	.54353E+03	.18708	.543001	.44400	24651.5	25164.8	244.778	108.46	151.58	.12680E+00	787	1.71770
340.000	.9136E+01	.53102E+03	.18586	.497725	.38839	26173.4	26698.8	249.358	110.59	155.29	.15675E+00	738	1.69787
350.000	.8910E+01	.51786E+03	.18513	.453962	.33577	27731.8	28270.6	253.916	112.66	159.21	.19054E+00	688	1.67719
360.000	.8670E+01	.50392E+03	.18497	.411543	.28612	29329.0	29882.7	258.459	114.60	163.37	.22807E+00	638	1.65548
370.000	.8413E+01	.48902E+03	.18545	.370286	.23939	30967.6	31538.1	262.995	116.33	167.84	.26918E+00	587	1.63247
380.000	.8136E+01	.47288E+03	.18674	.329985	.19555	32650.8	33240.8	267.535	117.74	172.74	.31364E+00	535	1.60781
390.000	.7830E+01	.45510E+03	.18905	.290375	.15459	34383.0	34996.1	272.092	118.64	178.33	.36106E+00	482	1.58096
400.000	.7484E+01	.43503E+03	.19283	.251087	.11649	36170.7	36812.1	276.690	118.66	185.15	.41087E+00	426	1.55102
410.000	.7079E+01	.41145E+03	.19891	.211516	.08130	38025.8	38703.9	281.366	116.68	194.15	.46222E+00	367	1.51637
420.000	.6566E+01	.38167E+03	.20933	.170475	.04919	39973.4	40704.3	286.172	104.55	203.54	.51590E+00	309	1.47344
430.000	.5803E+01	.33730E+03	.23135	.124862	.02100	42556.9	43384.0	292.473	148.80	311.92	.56822E+00	209	1.41113
440.000	.4087E+01	.23754E+03	.32104	.067978	.00533	46516.9	47691.4	302.363	148.91	541.84	.61522E+00	139	1.27823
450.000	.2736E+01	.15905E+03	.46883	.040559	.00997	50197.9	51952.0	311.947	144.39	315.00	.65032E+00	147	1.18050
460.000	.2264E+01	.13162E+03	.55424	.031493	.01655	52502.3	54622.1	317.819	142.63	235.09	.67793E+00	165	0.00000
470.000	.2006E+01	.11662E+03	.61219	.026624	.02225	54418.6	56810.9	322.528	142.55	206.54	.70151E+00	179	0.00000
480.000	.1833E+01	.10651E+03	.65631	.023425	.02726	56180.7	58800.1	326.716	143.24	192.74	.72232E+00	191	0.00000
490.000	.1703E+01	.98974E+02	.69190	.021105	.03177	57866.9	60685.8	330.605	144.35	185.11	.74100E+00	201	0.00000
500.000	.1600E+01	.93004E+02	.72159	.019319	.03591	59512.7	62512.5	334.296	145.70	180.63	.75792E+00	210	0.00000
520.000	.1444E+01	.83924E+02	.76890	.016708	.04333	62751.5	66075.9	341.284	148.84	176.48	.78755E+00	226	0.00000
540.000	.1328E+01	.77164E+02	.80530	.014860	.04995	65977.2	69592.9	347.921	152.27	175.57	.81265E+00	239	0.00000
560.000	.1236E+01	.71820E+02	.83431	.013464	.05597	69224.6	73109.3	354.316	155.82	176.26	.83420E+00	251	0.00000
580.000	.1160E+01	.67428E+02	.85801	.012363	.06156	72511.3	76649.0	360.526	159.41	177.82	.85287E+00	262	0.00000
600.000	.1096E+01	.63718E+02	.87771	.011465	.06680	75846.8	80225.5	366.588	162.99	179.89	.86916E+00	271	0.00000
620.000	.1041E+01	.60517E+02	.89432	.010716	.07176	79236.6	83846.8	372.525	166.53	182.27	.88347E+00	280	0.00000
640.000	.9929E+00	.57713E+02	.90846	.010078	.07650	82683.4	87517.6	378.352	170.01	184.83	.89612E+00	288	0.00000
660.000	.9501E+00	.55225E+02	.92062	.009527	.08104	86188.9	91240.8	384.080	173.41	187.50	.90733E+00	296	0.00000
680.000	.9117E+00	.52994E+02	.93116	.009044	.08542	89753.4	95018.0	389.718	176.74	190.22	.91729E+00	303	0.00000
700.000	.8770E+00	.50977E+02	.94035	.008617	.08967	93376.9	98849.8	395.272	179.99	192.96	.92618E+00	310	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 5.0 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
135.696	.1267E+02	.73671E+03	.34965	2.114412	2.27683	30.6	425.1	133.767	88.66	117.19	.22398E-06	1734	2.04079
140.000	.1261E+02	.73271E+03	.34075	2.050197	2.21212	532.5	929.1	137.421	88.12	116.92	.48445E-06	1713	2.03391
150.000	.1245E+02	.72346E+03	.32209	1.910889	2.06930	1694.4	2096.2	145.470	87.04	116.43	.24018E-05	1663	2.01798
160.000	.1229E+02	.71424E+03	.30586	1.783749	1.93573	2852.8	3259.7	152.975	86.24	116.20	.95115E-05	1615	2.00209
170.000	.1213E+02	.70503E+03	.29163	1.667056	1.81012	4010.4	4422.6	160.021	85.76	116.28	.31380E-04	1566	1.98623
180.000	.1197E+02	.69582E+03	.27908	1.559413	1.69146	5170.3	5587.9	166.677	85.62	116.69	.89061E-04	1518	1.97041
190.000	.1181E+02	.68658E+03	.26794	1.459677	1.57895	6335.5	6758.8	173.004	85.80	117.42	.22297E-03	1469	1.95459
200.000	.1165E+02	.67732E+03	.25803	1.366892	1.47197	7509.0	7938.1	179.052	86.30	118.47	.50226E-03	1421	1.93876
210.000	.1149E+02	.66801E+03	.24917	1.280258	1.37001	8694.0	9129.1	184.864	87.09	119.81	.10344E-02	1372	1.92289
220.000	.1133E+02	.65862E+03	.24123	1.199097	1.27269	9893.3	10334.6	190.474	88.12	121.43	.19732E-02	1324	1.90697
230.000	.1117E+02	.64916E+03	.23411	1.122827	1.17966	11109.6	11557.3	195.911	89.38	123.29	.35235E-02	1275	1.89097
240.000	.1100E+02	.63958E+03	.22771	1.050948	1.09069	12345.5	12799.9	201.202	90.83	125.36	.59423E-02	1226	1.87485
250.000	.1084E+02	.62988E+03	.22197	.983027	1.00554	13603.1	14064.5	206.365	92.44	127.64	.95341E-02	1178	1.85860
260.000	.1067E+02	.62002E+03	.21683	.918684	.92406	14884.3	15353.1	211.418	94.18	130.08	.14643E-01	1129	1.84217
270.000	.1049E+02	.60998E+03	.21223	.857585	.84611	16191.0	16667.4	216.375	96.03	132.69	.21638E-01	1081	1.82553
280.000	.1032E+02	.59974E+03	.20815	.799435	.77157	17524.4	18009.0	221.250	97.97	135.44	.30898E-01	1032	1.80863
290.000	.1014E+02	.58925E+03	.20455	.743973	.70036	18886.0	19379.2	226.053	99.98	138.35	.42793E-01	984	1.79144
300.000	.9952E+01	.57848E+03	.20141	.690962	.63239	20276.7	20779.1	230.794	102.05	141.39	.57660E-01	936	1.77388
310.000	.9762E+01	.56738E+03	.19873	.640190	.56762	21697.9	22210.1	235.482	104.17	144.58	.75792E-01	887	1.75591
320.000	.9564E+01	.55590E+03	.19649	.591463	.50597	23150.6	23673.4	240.125	106.32	147.93	.97413E-01	839	1.73745
330.000	.9359E+01	.54398E+03	.19471	.544602	.44741	24636.1	25170.4	244.730	108.47	151.44	.12268E+00	790	1.71841
340.000	.9145E+01	.53153E+03	.19341	.499439	.39190	26156.0	26702.8	249.305	110.60	155.12	.15165E+00	741	1.69867
350.000	.8920E+01	.51845E+03	.19263	.455810	.33939	27712.1	28272.6	253.857	112.66	158.99	.18433E+00	692	1.67811
360.000	.8682E+01	.50462E+03	.19241	.413551	.28985	29306.2	29882.1	258.393	114.60	163.08	.22064E+00	642	1.65655
370.000	.8428E+01	.48985E+03	.19285	.372493	.24325	30940.9	31534.2	262.920	116.33	167.45	.26042E+00	591	1.63374
380.000	.8153E+01	.47389E+03	.19410	.332443	.19957	32619.0	33232.3	267.448	117.73	172.19	.30344E+00	540	1.60934
390.000	.7852E+01	.45638E+03	.19638	.293164	.15879	34344.1	34980.9	271.988	118.62	177.53	.34936E+00	487	1.58287
400.000	.7513E+01	.43672E+03	.20009	.254337	.12091	36121.2	36786.6	276.559	118.62	183.84	.39761E+00	432	1.55351
410.000	.7120E+01	.41384E+03	.20600	.215463	.08599	37958.3	38660.6	281.192	116.60	191.72	.44742E+00	376	1.51985
420.000	.6633E+01	.38554E+03	.21586	.175633	.05423	39869.8	40623.6	285.908	104.35	197.77	.49958E+00	320	1.47896
430.000	.5949E+01	.34578E+03	.23509	.132776	.02636	42343.8	43184.2	291.930	148.24	288.02	.55071E+00	226	1.42287
440.000	.4641E+01	.26977E+03	.29447	.082111	.00752	45702.0	46779.3	300.186	148.04	463.31	.59805E+00	153	1.32008
450.000	.3113E+01	.18093E+03	.42931	.047570	.00851	49541.6	51147.9	310.008	145.69	358.17	.63587E+00	144	1.20715
460.000	.2485E+01	.14445E+03	.52605	.035405	.01470	52092.1	54104.1	316.509	143.55	252.85	.66535E+00	160	0.00000
470.000	.2168E+01	.12599E+03	.59027	.029369	.02049	54113.2	56419.9	321.491	143.21	215.65	.69020E+00	175	0.00000
480.000	.1963E+01	.11408E+03	.63832	.025561	.02564	55933.0	58480.5	325.831	143.74	198.38	.71201E+00	188	0.00000
490.000	.1814E+01	.10542E+03	.67664	.022865	.03028	57656.3	60413.0	329.816	144.75	188.99	.73152E+00	198	0.00000
500.000	.1698E+01	.98684E+02	.70839	.020823	.03453	59328.2	62273.2	333.575	146.03	183.51	.74916E+00	208	0.00000
520.000	.1524E+01	.88604E+02	.75864	.017883	.04215	62602.0	65882.0	340.652	149.08	178.28	.78000E+00	224	0.00000
540.000	.1397E+01	.81210E+02	.79706	.015831	.04893	65850.3	69429.0	347.346	152.45	176.83	.80608E+00	238	0.00000
560.000	.1298E+01	.75422E+02	.82757	.014296	.05509	69113.7	72967.0	353.779	155.96	177.19	.82846E+00	250	0.00000
580.000	.1216E+01	.70698E+02	.85243	.013093	.06079	72412.5	76523.2	360.019	159.53	178.55	.84785E+00	260	0.00000
600.000	.1148E+01	.66727E+02	.87305	.012118	.06613	75757.5	80112.8	366.104	163.09	180.48	.86475E+00	270	0.00000
620.000	.1089E+01	.63316E+02	.89040	.011308	.07117	79154.8	83744.9	372.058	166.61	182.76	.87960E+00	279	0.00000
640.000	.1038E+01	.60337E+02	.90517	.010621	.07598	82608.0	87424.7	377.899	170.08	185.25	.89272E+00	287	0.00000
660.000	.9927E+00	.57700E+02	.91785	.010029	.08060	86118.8	91155.6	383.639	173.48	187.86	.90435E+00	295	0.00000
680.000	.9521E+00	.55341E+02	.92883	.009512	.08504	89687.9	94939.4	389.287	176.80	190.53	.91467E+00	302	0.00000
700.000	.9155E+00	.53212E+02	.93839	.009056	.08934	93315.4	98777.0	394.849	180.04	193.23	.92389E+00	309	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 5.2 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	Cv J/(mol•K)	Cp J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
135.730	.1268E+02	.73676E+03	.36351	2.114591	2.27851	31.8	442.1	133.776	88.66	117.19	.21975E-06	1735	2.04088
140.000	.1261E+02	.73280E+03	.35433	2.050901	2.21432	529.7	942.2	137.401	88.13	116.91	.47221E-06	1713	2.03406
150.000	.1245E+02	.72356E+03	.33493	1.911631	2.07155	1691.4	2109.1	145.449	87.05	116.42	.23394E-05	1664	2.01813
160.000	.1229E+02	.71434E+03	.31805	1.784525	1.93802	2849.5	3272.6	152.954	86.25	116.20	.92583E-05	1615	2.00225
170.000	.1213E+02	.70514E+03	.30325	1.667864	1.81246	4006.8	4435.4	159.999	85.77	116.27	.30527E-04	1567	1.98641
180.000	.1197E+02	.69593E+03	.29019	1.560253	1.69385	5166.4	5600.7	166.655	85.63	116.67	.86596E-04	1519	1.97060
190.000	.1181E+02	.68671E+03	.27861	1.460547	1.58139	6331.2	6771.4	172.982	85.81	117.40	.21670E-03	1470	1.95479
200.000	.1166E+02	.67746E+03	.26830	1.367793	1.47446	7504.4	7950.6	179.029	86.31	118.45	.48796E-03	1422	1.93898
210.000	.1150E+02	.66815E+03	.25908	1.281190	1.37257	8689.0	9141.4	184.839	87.09	119.79	.10046E-02	1373	1.92313
220.000	.1133E+02	.65878E+03	.25082	1.200062	1.27530	9887.9	10346.7	190.448	88.13	121.41	.19157E-02	1325	1.90723
230.000	.1117E+02	.64933E+03	.24341	1.123827	1.18233	11103.7	11569.2	195.885	89.39	123.26	.34199E-02	1276	1.89124
240.000	.1101E+02	.63976E+03	.23675	1.051985	1.09342	12339.1	12811.5	201.174	90.84	125.33	.57660E-02	1228	1.87515
250.000	.1084E+02	.63008E+03	.23078	.984104	1.00834	13596.1	14075.8	206.336	92.45	127.60	.92492E-02	1179	1.85892
260.000	.1067E+02	.62024E+03	.22542	.919804	.92692	14876.7	15364.0	211.388	94.19	130.04	.14202E-01	1131	1.84252
270.000	.1050E+02	.61022E+03	.22063	.858752	.84904	16182.6	16677.9	216.344	96.04	132.64	.20983E-01	1082	1.82591
280.000	.1032E+02	.60000E+03	.21638	.800654	.77457	17515.3	18019.0	221.217	97.98	135.39	.29958E-01	1034	1.80905
290.000	.1014E+02	.58954E+03	.21263	.745249	.70343	18875.9	19388.6	226.018	99.99	138.28	.41485E-01	986	1.79189
300.000	.9958E+01	.57880E+03	.20935	.692303	.63554	20265.7	20787.9	230.757	102.06	141.31	.55891E-01	938	1.77439
310.000	.9768E+01	.56773E+03	.20655	.641604	.57084	21685.6	22218.0	235.442	104.18	144.49	.73458E-01	889	1.75647
320.000	.9571E+01	.55630E+03	.20421	.592960	.50928	23136.9	23680.2	240.081	106.32	147.82	.94406E-01	841	1.73807
330.000	.9367E+01	.54442E+03	.20234	.546194	.45081	24620.9	25176.0	244.683	108.48	151.30	.11888E+00	792	1.71911
340.000	.9153E+01	.53204E+03	.20096	.501141	.39539	26138.8	26706.9	249.253	110.60	154.95	.14695E+00	744	1.69947
350.000	.8930E+01	.51904E+03	.20010	.457642	.34299	27692.5	28274.8	253.800	112.66	158.77	.17861E+00	695	1.67902
360.000	.8693E+01	.50530E+03	.19983	.415540	.29357	29283.7	29881.8	258.328	114.60	162.80	.21379E+00	645	1.65760
370.000	.8442E+01	.49066E+03	.20023	.374673	.24710	30914.7	31530.7	262.847	116.32	167.07	.25234E+00	595	1.63498
380.000	.8170E+01	.47489E+03	.20144	.334863	.20356	32587.9	33224.3	267.362	117.72	171.67	.29404E+00	544	1.61085
390.000	.7873E+01	.45762E+03	.20368	.295898	.16295	34306.1	34966.6	271.886	118.60	176.76	.33857E+00	492	1.58473
400.000	.7541E+01	.43834E+03	.20733	.257498	.12527	36073.2	36762.7	276.433	118.58	182.63	.38538E+00	439	1.55592
410.000	.7159E+01	.41610E+03	.21308	.219253	.09059	37894.1	38620.4	281.026	116.52	189.56	.43376E+00	383	1.52316
420.000	.6694E+01	.38907E+03	.22246	.180457	.05912	39774.4	40551.3	285.664	104.19	193.02	.48451E+00	330	1.48402
430.000	.6068E+01	.35270E+03	.23969	.139680	.03152	42167.3	43024.3	291.480	147.83	272.20	.53448E+00	240	1.43252
440.000	.5018E+01	.29169E+03	.28324	.093952	.01113	45159.7	46195.9	298.766	147.05	385.44	.58158E+00	170	1.34913
450.000	.3530E+01	.20518E+03	.39370	.055803	.00820	48855.6	50328.7	308.053	146.52	382.55	.62136E+00	146	1.23722
460.000	.2733E+01	.15886E+03	.49744	.039903	.01314	51647.2	53549.7	315.137	144.44	272.79	.65274E+00	157	0.00000
470.000	.2343E+01	.13617E+03	.56801	.032410	.01887	53789.2	56008.9	320.428	143.87	225.88	.67892E+00	172	0.00000
480.000	.2101E+01	.12213E+03	.62011	.027879	.02410	55674.1	58149.0	324.935	144.25	204.56	.70174E+00	184	0.00000
490.000	.1930E+01	.11219E+03	.66126	.024749	.02885	57438.3	60132.3	329.025	145.15	193.19	.72209E+00	195	0.00000
500.000	.1799E+01	.10459E+03	.69512	.022417	.03320	59138.5	62028.3	332.856	146.36	186.57	.74045E+00	205	0.00000
520.000	.1607E+01	.93415E+02	.74835	.019112	.04100	62449.5	65685.0	340.028	149.31	180.17	.77250E+00	222	0.00000
540.000	.1468E+01	.85340E+02	.78882	.016839	.04793	65721.5	69263.2	346.780	152.63	178.13	.79957E+00	236	0.00000
560.000	.1361E+01	.79081E+02	.82085	.015155	.05422	69001.6	72823.6	353.254	156.11	178.15	.82278E+00	248	0.00000
580.000	.1273E+01	.74009E+02	.84687	.013844	.06003	72312.8	76396.7	359.524	159.65	179.30	.84286E+00	259	0.00000
600.000	.1200E+01	.69767E+02	.86841	.012788	.06546	75667.5	79999.8	365.631	163.19	181.08	.86039E+00	269	0.00000
620.000	.1138E+01	.66137E+02	.88651	.011914	.07060	79072.7	83642.7	371.603	166.69	183.26	.87576E+00	278	0.00000
640.000	.1083E+01	.62977E+02	.90190	.011175	.07548	82532.3	87331.6	377.459	170.15	185.67	.88935E+00	286	0.00000
660.000	.1036E+01	.60188E+02	.91511	.010540	.08016	86048.6	91070.3	383.211	173.54	188.21	.90139E+00	294	0.00000
680.000	.9927E+00	.57698E+02	.92652	.009988	.08467	89622.3	94860.7	388.869	176.85	190.84	.91209E+00	302	0.00000
700.000	.9541E+00	.55454E+02	.93646	.009500	.08902	93253.8	98704.2	394.439	180.09	193.51	.92163E+00	309	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 5.5 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	Cv J/(mol•K)	Cp J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
135.780	.1268E+02	.73685E+03	.38430	2.114861	2.28102	33.7	467.6	133.789	88.67	117.17	.21414E-06	1736	2.04101
140.000	.1261E+02	.73294E+03	.37470	2.051958	2.21763	525.6	961.8	137.371	88.14	116.91	.45567E-06	1714	2.03428
150.000	.1245E+02	.72370E+03	.35419	1.912744	2.07492	1686.9	2128.6	145.419	87.06	116.41	.22549E-05	1665	2.01837
160.000	.1229E+02	.71450E+03	.33633	1.785689	1.94146	2844.6	3292.0	152.923	86.26	116.18	.89154E-05	1617	2.00251
170.000	.1213E+02	.70530E+03	.32067	1.669076	1.81597	4001.4	4454.7	159.967	85.79	116.26	.29371E-04	1568	1.98668
180.000	.1198E+02	.69611E+03	.30686	1.561511	1.69743	5160.5	5619.8	166.622	85.64	116.66	.83255E-04	1520	1.97089
190.000	.1182E+02	.68690E+03	.29460	1.461850	1.58505	6324.9	6790.3	172.947	85.83	117.38	.20820E-03	1472	1.95510
200.000	.1166E+02	.67766E+03	.28369	1.369142	1.47821	7497.5	7969.3	178.994	86.33	118.43	.46854E-03	1424	1.93931
210.000	.1150E+02	.66837E+03	.27394	1.282587	1.37639	8681.5	9159.8	184.803	87.11	119.77	.96410E-03	1375	1.92348
220.000	.1134E+02	.65902E+03	.26519	1.201508	1.27921	9879.7	10364.8	190.411	88.15	121.37	.18376E-02	1327	1.90761
230.000	.1118E+02	.64958E+03	.25735	1.125324	1.18634	11094.9	11587.0	195.846	89.41	123.22	.32790E-02	1278	1.89166
240.000	.1101E+02	.64004E+03	.25030	1.053538	1.09751	12329.4	12828.9	201.133	90.85	125.29	.55264E-02	1230	1.87560
250.000	.1085E+02	.63037E+03	.24398	.985715	1.01252	13585.6	14092.7	206.293	92.46	127.55	.88618E-02	1181	1.85940
260.000	.1068E+02	.62056E+03	.23830	.921479	.93121	14865.3	15380.5	211.343	94.20	129.98	.13603E-01	1133	1.84304
270.000	.1050E+02	.61057E+03	.23323	.860497	.85342	16170.2	16693.7	216.296	96.05	132.57	.20093E-01	1085	1.82648
280.000	.1033E+02	.60038E+03	.22872	.802476	.77906	17501.6	18034.1	221.167	97.99	135.31	.28680E-01	1037	1.80967
290.000	.1015E+02	.58996E+03	.22473	.747156	.70803	18860.9	19402.8	225.965	100.00	138.19	.39706E-01	989	1.79258
300.000	.9966E+01	.57927E+03	.22125	.694305	.64025	20249.1	20801.0	230.700	102.07	141.20	.53484E-01	941	1.77514
310.000	.9777E+01	.56826E+03	.21826	.643713	.57567	21667.3	22229.9	235.381	104.19	144.36	.70284E-01	893	1.75730
320.000	.9581E+01	.55688E+03	.21576	.595191	.51423	23116.6	23690.7	240.016	106.34	147.65	.90313E-01	845	1.73900
330.000	.9378E+01	.54509E+03	.21375	.548565	.45589	24598.1	25184.6	244.612	108.49	151.10	.11371E+00	796	1.72015
340.000	.9166E+01	.53279E+03	.21225	.503673	.40061	26113.2	26713.3	249.176	110.61	154.70	.14055E+00	748	1.70065
350.000	.8945E+01	.51991E+03	.21130	.460364	.34836	27663.4	28278.3	253.714	112.67	158.46	.17083E+00	699	1.68037
360.000	.8711E+01	.50632E+03	.21094	.418487	.29910	29250.4	29881.8	258.232	114.60	162.39	.20447E+00	651	1.65917
370.000	.8462E+01	.49186E+03	.21127	.377895	.25282	30876.0	31525.9	262.738	116.32	166.53	.24134E+00	601	1.63682
380.000	.8195E+01	.47634E+03	.21242	.338426	.20949	32542.1	33213.2	267.237	117.71	170.93	.28125E+00	551	1.61305
390.000	.7904E+01	.45943E+03	.21458	.299899	.16911	34250.8	34946.6	271.737	118.57	175.69	.32387E+00	500	1.58744
400.000	.7582E+01	.44068E+03	.21812	.262088	.13170	36003.9	36729.3	276.251	118.53	180.97	.36873E+00	448	1.55938
410.000	.7214E+01	.41930E+03	.22365	.224679	.09734	37802.9	38565.4	280.790	116.42	186.72	.41515E+00	395	1.52783
420.000	.6776E+01	.39386E+03	.23243	.187186	.06623	39643.9	40455.6	285.330	103.99	187.24	.46396E+00	345	1.49089
430.000	.6215E+01	.36124E+03	.24752	.148754	.03893	41946.7	42831.6	290.919	147.37	256.22	.51227E+00	260	1.44449
440.000	.5386E+01	.31306E+03	.27913	.107925	.01752	44630.4	45651.6	297.398	145.96	319.42	.55858E+00	195	1.37791
450.000	.4122E+01	.23958E+03	.35663	.069010	.00950	47940.2	49274.6	305.536	146.73	375.09	.59992E+00	155	1.28085
460.000	.3152E+01	.18322E+03	.45621	.047825	.01175	50930.9	52675.8	313.015	145.53	300.54	.63388E+00	155	0.00000
470.000	.2633E+01	.15303E+03	.53457	.037596	.01683	53269.4	55358.4	318.787	144.80	242.75	.66206E+00	167	0.00000
480.000	.2325E+01	.13516E+03	.59266	.031727	.02203	55264.8	57630.0	323.571	144.99	214.78	.68643E+00	180	0.00000
490.000	.2116E+01	.12297E+03	.63809	.027823	.02686	57097.3	59697.0	327.833	145.74	200.03	.70807E+00	191	0.00000
500.000	.1960E+01	.11390E+03	.67515	.024986	.03132	58844.2	61651.0	331.781	146.85	191.51	.72751E+00	202	0.00000
520.000	.1736E+01	.10088E+03	.73292	.021063	.03936	62215.4	65384.2	339.104	149.67	183.14	.76136E+00	219	0.00000
540.000	.1578E+01	.91696E+02	.77650	.018422	.04649	65525.1	69011.4	345.949	152.90	180.15	.78990E+00	234	0.00000
560.000	.1457E+01	.84680E+02	.81080	.016495	.05296	68831.3	72606.5	352.486	156.32	179.64	.81433E+00	246	0.00000
580.000	.1360E+01	.79053E+02	.83857	.015010	.05893	72161.9	76205.8	358.801	159.82	180.45	.83547E+00	257	0.00000
600.000	.1280E+01	.74384E+02	.86150	.013823	.06450	75531.6	79829.4	364.944	163.33	182.00	.85390E+00	268	0.00000
620.000	.1211E+01	.70413E+02	.88073	.012847	.06976	78948.8	83489.0	370.943	166.82	184.01	.87007E+00	277	0.00000
640.000	.1152E+01	.66971E+02	.89705	.012026	.07475	82418.4	87191.8	376.821	170.26	186.30	.88436E+00	285	0.00000
660.000	.1100E+01	.63945E+02	.91103	.011324	.07953	85942.9	90942.2	382.591	173.63	188.76	.89702E+00	294	0.00000
680.000	.1054E+01	.61253E+02	.92310	.010715	.08412	89523.7	94742.8	388.264	176.94	191.31	.90826E+00	301	0.00000
700.000	.1012E+01	.58833E+02	.93361	.010180	.08856	93161.4	98595.1	393.847	180.16	193.92	.91829E+00	308	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 6.0 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	Cv J/(mol•K)	Cp J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
135.863	.1268E+02	.73699E+03	.41890	2.115312	2.28521	36.8	510.0	133.811	88.69	117.15	.20643E-06	1737	2.04123
140.000	.1261E+02	.73316E+03	.40864	2.053717	2.22313	518.7	994.4	137.321	88.17	116.89	.43217E-06	1716	2.03464
150.000	.1246E+02	.72395E+03	.38626	1.914596	2.08053	1679.4	2161.1	145.368	87.09	116.40	.21346E-05	1667	2.01876
160.000	.1230E+02	.71475E+03	.36677	1.787626	1.94719	2836.4	3324.3	152.871	86.29	116.16	.84261E-05	1619	2.00292
170.000	.1214E+02	.70558E+03	.34969	1.671092	1.82181	3992.5	4486.8	159.914	85.81	116.23	.27720E-04	1570	1.98713
180.000	.1198E+02	.69640E+03	.33461	1.563604	1.70340	5150.8	5651.6	166.567	85.67	116.63	.78475E-04	1522	1.97137
190.000	.1182E+02	.68722E+03	.32124	1.464019	1.59115	6314.3	6821.8	172.891	85.85	117.35	.19603E-03	1474	1.95561
200.000	.1166E+02	.67800E+03	.30932	1.371387	1.48444	7486.1	8000.4	178.935	86.35	118.39	.44071E-03	1426	1.93986
210.000	.1151E+02	.66873E+03	.29868	1.284909	1.38276	8669.1	9190.6	184.742	87.13	119.72	.90604E-03	1378	1.92408
220.000	.1134E+02	.65941E+03	.28913	1.203911	1.28572	9866.2	10395.1	190.348	88.17	121.32	.17255E-02	1330	1.90824
230.000	.1118E+02	.65000E+03	.28056	1.127812	1.19299	11080.2	11616.8	195.781	89.43	123.17	.30769E-02	1281	1.89234
240.000	.1102E+02	.64049E+03	.27286	1.056115	1.10432	12313.5	12858.0	201.065	90.88	125.22	.51824E-02	1233	1.87634
250.000	.1085E+02	.63087E+03	.26595	.988390	1.01948	13568.3	14121.1	206.222	92.48	127.47	.83055E-02	1185	1.86020
260.000	.1069E+02	.62109E+03	.25974	.924258	.93833	14846.4	15407.9	211.268	94.22	129.89	.12743E-01	1137	1.84391
270.000	.1051E+02	.61116E+03	.25419	.863390	.86071	16149.5	16720.2	216.218	96.07	132.46	.18813E-01	1089	1.82742
280.000	.1034E+02	.60102E+03	.24924	.805495	.78651	17479.1	18059.3	221.084	98.01	135.18	.26842E-01	1041	1.81070
290.000	.1016E+02	.59066E+03	.24487	.750314	.71566	18836.1	19426.6	225.877	100.03	138.03	.37148E-01	993	1.79370
300.000	.9979E+01	.58004E+03	.24104	.697617	.64806	20221.9	20823.1	230.607	102.10	141.02	.50023E-01	946	1.77638
310.000	.9791E+01	.56912E+03	.23774	.647199	.58367	21637.2	22250.0	235.281	104.21	144.14	.65717E-01	898	1.75868
320.000	.9598E+01	.55785E+03	.23497	.598873	.52243	23083.2	23708.3	239.908	106.36	147.39	.84426E-01	850	1.74053
330.000	.9397E+01	.54617E+03	.23272	.552471	.46430	24560.8	25199.3	244.495	108.51	150.77	.10628E+00	803	1.72186
340.000	.9188E+01	.53403E+03	.23101	.507837	.40925	26071.3	26724.4	249.048	110.63	154.30	.13135E+00	755	1.70258
350.000	.8969E+01	.52132E+03	.22988	.464828	.35724	27616.0	28284.9	253.573	112.68	157.96	.15962E+00	707	1.68258
360.000	.8739E+01	.50796E+03	.22937	.423308	.30824	29196.1	29882.7	258.076	114.61	161.75	.19105E+00	659	1.66171
370.000	.8496E+01	.49381E+03	.22957	.383142	.26224	30813.2	31519.5	262.561	116.32	165.69	.22551E+00	611	1.63980
380.000	.8235E+01	.47867E+03	.23060	.344197	.21922	32468.4	33197.0	267.034	117.69	169.79	.26283E+00	562	1.61659
390.000	.7954E+01	.46230E+03	.23264	.306330	.17919	34162.4	34916.8	271.499	118.53	174.08	.30271E+00	512	1.59176
400.000	.7644E+01	.44433E+03	.23600	.269378	.14217	35894.9	36679.8	275.963	118.45	178.56	.34475E+00	462	1.56480
410.000	.7298E+01	.42417E+03	.24119	.233140	.10825	37662.8	38485.0	280.426	116.28	182.79	.38833E+00	412	1.53496
420.000	.6896E+01	.40083E+03	.24915	.197350	.07760	39451.7	40321.8	284.837	103.73	179.99	.43430E+00	366	1.50093
430.000	.6408E+01	.37246E+03	.26190	.161628	.05065	41651.5	42587.9	290.168	146.84	239.77	.48010E+00	287	1.46031
440.000	.5767E+01	.33518E+03	.28441	.125506	.02857	44073.8	45114.3	295.974	144.88	270.39	.52470E+00	230	1.40818
450.000	.4860E+01	.28251E+03	.32993	.089884	.01490	46851.1	48085.6	302.648	145.84	323.53	.56647E+00	181	1.33691
460.000	.3874E+01	.22515E+03	.40499	.063125	.01272	49782.0	51331.0	309.781	146.29	311.48	.60315E+00	164	0.00000
470.000	.3179E+01	.18479E+03	.48295	.047975	.01512	52343.8	54231.1	316.020	146.02	267.80	.63435E+00	166	0.00000
480.000	.2743E+01	.15943E+03	.54810	.039232	.01945	54533.4	56720.8	321.264	146.10	232.95	.66126E+00	176	0.00000
490.000	.2455E+01	.14267E+03	.60000	.033672	.02410	56494.3	58938.8	325.838	146.68	212.51	.68501E+00	186	0.00000
500.000	.2247E+01	.13062E+03	.64221	.029786	.02860	58328.8	60998.7	330.000	147.64	200.48	.70626E+00	197	0.00000
520.000	.1962E+01	.11402E+03	.70745	.024616	.03686	61811.2	64869.9	337.593	150.25	188.46	.74307E+00	215	0.00000
540.000	.1767E+01	.10272E+03	.75617	.021262	.04427	65189.1	68584.2	344.603	153.34	183.72	.77402E+00	230	0.00000
560.000	.1622E+01	.94304E+02	.79425	.018871	.05100	68541.9	72240.0	351.251	156.68	182.23	.80048E+00	243	0.00000
580.000	.1508E+01	.87667E+02	.82491	.017061	.05720	71906.6	75884.7	357.646	160.11	182.43	.82335E+00	255	0.00000
600.000	.1415E+01	.82230E+02	.85015	.015632	.06298	75302.5	79543.6	363.848	163.57	183.58	.84327E+00	265	0.00000
620.000	.1336E+01	.77651E+02	.87124	.014469	.06843	78740.6	83231.8	369.895	167.02	185.31	.86077E+00	275	0.00000
640.000	.1268E+01	.73713E+02	.88909	.013500	.07359	82227.2	86958.3	375.810	170.43	187.39	.87620E+00	284	0.00000
660.000	.1209E+01	.70273E+02	.90436	.012677	.07852	85766.0	90728.7	381.610	173.78	189.68	.88988E+00	292	0.00000
680.000	.1157E+01	.67227E+02	.91752	.011967	.08326	89358.9	94546.5	387.309	177.07	192.11	.90201E+00	300	0.00000
700.000	.1110E+01	.64503E+02	.92896	.011346	.08783	93007.0	98413.7	392.914	180.28	194.62	.91284E+00	307	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 6.5 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
135.946	.1268E+02	.73713E+03	.45344	2.115767	2.28940	39.9	552.5	133.833	88.70	117.14	.20036E-06	1738	2.04145
140.000	.1262E+02	.73339E+03	.44256	2.055475	2.22863	511.9	1027.1	137.271	88.19	116.88	.41274E-06	1718	2.03500
150.000	.1246E+02	.72419E+03	.41831	1.916446	2.08613	1671.9	2193.6	145.317	87.11	116.38	.20349E-05	1669	2.01914
160.000	.1230E+02	.71501E+03	.39719	1.789560	1.95290	2828.2	3356.6	152.819	86.31	116.14	.80193E-05	1621	2.00334
170.000	.1214E+02	.70585E+03	.37868	1.673105	1.82765	3983.6	4518.9	159.860	85.83	116.21	.26344E-04	1573	1.98757
180.000	.1199E+02	.69670E+03	.36234	1.565693	1.70936	5141.1	5683.4	166.512	85.69	116.60	.74487E-04	1525	1.97184
190.000	.1183E+02	.68753E+03	.34785	1.466183	1.59723	6303.8	6853.3	172.834	85.88	117.32	.18586E-03	1477	1.95613
200.000	.1167E+02	.67833E+03	.33494	1.373626	1.49065	7474.7	8031.6	178.877	86.37	118.35	.41743E-03	1429	1.94041
210.000	.1151E+02	.66909E+03	.32339	1.287225	1.38911	8656.7	9221.4	184.682	87.16	119.68	.85741E-03	1381	1.92466
220.000	.1135E+02	.65979E+03	.31304	1.206305	1.29221	9852.8	10425.4	190.285	88.19	121.27	.16316E-02	1332	1.90888
230.000	.1119E+02	.65042E+03	.30375	1.130290	1.19963	11065.7	11646.5	195.716	89.45	123.11	.29074E-02	1284	1.89302
240.000	.1103E+02	.64094E+03	.29540	1.058682	1.11110	12297.7	12887.2	200.998	90.90	125.15	.48938E-02	1236	1.87707
250.000	.1086E+02	.63135E+03	.28789	.991051	1.02642	13551.1	14149.5	206.152	92.51	127.39	.78383E-02	1188	1.86100
260.000	.1069E+02	.62163E+03	.28115	.927022	.94542	14827.7	15435.4	211.194	94.25	129.80	.12020E-01	1141	1.84477
270.000	.1052E+02	.61174E+03	.27511	.866266	.86796	16129.1	16746.7	216.140	96.10	132.35	.17737E-01	1093	1.82836
280.000	.1035E+02	.60166E+03	.26973	.808493	.79394	17456.7	18084.7	221.002	98.04	135.05	.25297E-01	1045	1.81172
290.000	.1017E+02	.59136E+03	.26496	.753447	.72325	18811.7	19450.5	225.790	100.05	137.88	.34997E-01	998	1.79482
300.000	.9993E+01	.58081E+03	.26078	.700900	.65583	20194.9	20845.4	230.514	102.12	140.84	.47111E-01	951	1.77761
310.000	.9806E+01	.56997E+03	.25717	.650649	.59163	21607.5	22270.3	235.182	104.23	143.92	.61875E-01	903	1.76003
320.000	.9614E+01	.55880E+03	.25412	.602512	.53058	23050.2	23726.3	239.802	106.38	147.13	.79471E-01	856	1.74203
330.000	.9415E+01	.54724E+03	.25162	.556323	.47265	24524.1	25214.5	244.380	108.52	150.46	.10002E+00	809	1.72354
340.000	.9208E+01	.53523E+03	.24970	.511935	.41781	26030.2	26736.1	248.923	110.64	153.91	.12360E+00	762	1.70448
350.000	.8993E+01	.52271E+03	.24838	.469209	.36602	27569.6	28292.4	253.435	112.69	157.48	.15019E+00	715	1.68473
360.000	.8767E+01	.50956E+03	.24771	.428020	.31726	29143.4	29884.8	257.923	114.61	161.15	.17975E+00	667	1.66418
370.000	.8528E+01	.49568E+03	.24776	.388248	.27152	30752.5	31514.7	262.389	116.32	164.91	.21218E+00	620	1.64267
380.000	.8274E+01	.48090E+03	.24865	.349778	.22878	32397.6	33183.2	266.838	117.68	168.75	.24731E+00	572	1.61998
390.000	.8000E+01	.46502E+03	.25055	.312495	.18906	34078.4	34890.8	271.272	118.50	172.65	.28488E+00	524	1.59585
400.000	.7703E+01	.44772E+03	.25373	.276280	.15237	35792.8	36636.7	275.692	118.39	176.50	.32452E+00	476	1.56986
410.000	.7373E+01	.42857E+03	.25860	.241006	.11879	37534.7	38416.2	280.092	116.17	179.61	.36569E+00	428	1.54143
420.000	.7000E+01	.40685E+03	.26592	.206525	.08848	39283.0	40211.6	284.404	103.53	174.62	.40924E+00	386	1.50965
430.000	.6561E+01	.38138E+03	.27709	.172671	.06176	41412.2	42402.8	289.558	146.49	229.44	.45283E+00	311	1.47298
440.000	.6022E+01	.35001E+03	.29506	.139322	.03938	43692.2	44771.7	295.003	144.23	247.13	.49570E+00	259	1.42874
450.000	.5323E+01	.30939E+03	.32637	.106902	.02318	46175.5	47396.6	300.899	144.94	279.66	.53676E+00	211	1.37293
460.000	.4480E+01	.26037E+03	.37939	.078796	.01618	48870.0	50321.1	307.325	146.06	297.43	.57444E+00	181	0.00000
470.000	.3737E+01	.21720E+03	.44512	.059862	.01617	51456.9	53196.4	313.510	146.58	274.90	.60766E+00	174	0.00000
480.000	.3199E+01	.18396E+03	.50906	.048072	.01858	53775.2	55806.9	319.008	146.91	247.26	.63676E+00	176	0.00000
490.000	.2826E+01	.16429E+03	.56447	.040477	.02239	55860.2	58159.9	323.860	147.48	224.71	.66250E+00	184	0.00000
500.000	.2560E+01	.14880E+03	.61074	.035274	.02658	57787.9	60326.9	328.239	148.36	209.80	.68547E+00	193	0.00000
520.000	.2202E+01	.12800E+03	.68271	.028569	.03478	61391.6	64343.3	336.118	150.80	194.09	.72517E+00	211	0.00000
540.000	.1966E+01	.11428E+03	.73633	.024363	.04232	64843.5	68149.5	343.301	153.77	187.48	.75847E+00	227	0.00000
560.000	.1794E+01	.10429E+03	.77808	.021432	.04924	68246.2	71869.0	350.065	157.02	184.94	.78691E+00	240	0.00000
580.000	.1661E+01	.96533E+02	.81158	.019249	.05563	71647.0	75560.8	356.543	160.39	184.49	.81149E+00	252	0.00000
600.000	.1553E+01	.90259E+02	.83906	.017548	.06159	75070.5	79256.3	362.807	163.81	185.21	.83288E+00	263	0.00000
620.000	.1463E+01	.85025E+02	.86198	.016177	.06720	78530.4	82973.9	368.901	167.22	186.63	.85166E+00	273	0.00000
640.000	.1386E+01	.80558E+02	.88134	.015044	.07252	82034.7	86724.6	374.855	170.60	188.49	.86822E+00	283	0.00000
660.000	.1319E+01	.76679E+02	.89788	.014087	.07760	85588.2	90515.3	380.687	173.94	190.62	.88289E+00	291	0.00000
680.000	.1260E+01	.73262E+02	.91211	.013267	.08247	89193.6	94350.6	386.412	177.20	192.92	.89591E+00	299	0.00000
700.000	.1208E+01	.70218E+02	.92446	.012554	.08715	92852.4	98232.9	392.039	180.40	195.33	.90753E+00	307	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 7.0 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	Cv J/(mol•K)	Cp J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
136.029	.1268E+02	.73727E+03	.48793	2.116224	2.29359	43.1	594.9	133.856	88.72	117.12	.19563E-06	1740	2.04166
140.000	.1262E+02	.73361E+03	.47646	2.057233	2.23413	505.1	1059.7	137.221	88.22	116.86	.39653E-06	1720	2.03536
150.000	.1246E+02	.72442E+03	.45033	1.918295	2.09173	1664.5	2226.1	145.266	87.14	116.36	.19513E-05	1671	2.01953
160.000	.1231E+02	.71527E+03	.42759	1.791492	1.95862	2820.1	3388.9	152.766	86.34	116.12	.76775E-05	1623	2.00375
170.000	.1215E+02	.70613E+03	.40765	1.675115	1.83348	3974.8	4551.0	159.807	85.86	116.19	.25185E-04	1575	1.98802
180.000	.1199E+02	.69699E+03	.39005	1.567778	1.71531	5131.5	5715.3	166.457	85.71	116.58	.71121E-04	1527	1.97232
190.000	.1183E+02	.68784E+03	.37444	1.468342	1.60331	6293.4	6884.9	172.778	85.90	117.29	.17726E-03	1479	1.95663
200.000	.1168E+02	.67867E+03	.36052	1.375859	1.49686	7463.3	8062.8	178.819	86.40	118.32	.39773E-03	1431	1.94095
210.000	.1152E+02	.66945E+03	.34808	1.289533	1.39545	8644.4	9252.2	184.622	87.18	119.64	.81622E-03	1383	1.92525
220.000	.1136E+02	.66018E+03	.33693	1.208692	1.29869	9839.5	10455.8	190.223	88.22	121.22	.15520E-02	1335	1.90950
230.000	.1120E+02	.65083E+03	.32691	1.132759	1.20625	11051.2	11676.4	195.651	89.48	123.05	.27635E-02	1287	1.89370
240.000	.1103E+02	.64139E+03	.31790	1.061238	1.11787	12282.0	12916.3	200.931	90.92	125.09	.46486E-02	1240	1.87780
250.000	.1087E+02	.63184E+03	.30979	.993700	1.03334	13534.0	14177.9	206.081	92.53	127.31	.74414E-02	1192	1.86178
260.000	.1070E+02	.62215E+03	.30252	.929771	.95249	14809.1	15463.1	211.121	94.27	129.71	.11405E-01	1144	1.84562
270.000	.1053E+02	.61231E+03	.29600	.869124	.87519	16108.8	16773.3	216.063	96.12	132.25	.16822E-01	1097	1.82928
280.000	.1036E+02	.60228E+03	.29018	.811470	.80133	17434.6	18110.1	220.921	98.06	134.93	.23982E-01	1050	1.81273
290.000	.1019E+02	.59205E+03	.28501	.756555	.73081	18787.4	19474.7	225.704	100.07	137.73	.33166E-01	1002	1.79592
300.000	.1001E+02	.58157E+03	.28048	.704154	.66357	20168.3	20867.9	230.422	102.14	140.66	.44632E-01	955	1.77882
310.000	.9820E+01	.57081E+03	.27655	.654064	.59954	21578.2	22291.0	235.084	104.26	143.72	.58602E-01	909	1.76137
320.000	.9630E+01	.55973E+03	.27321	.606108	.53868	23017.8	23744.7	239.697	106.40	146.88	.75250E-01	862	1.74352
330.000	.9433E+01	.54829E+03	.27046	.560125	.48094	24488.1	25230.2	244.266	108.54	150.16	.94694E-01	815	1.72520
340.000	.9229E+01	.53642E+03	.26831	.515969	.42630	25989.9	26748.4	248.799	110.66	153.55	.11699E+00	769	1.70633
350.000	.9016E+01	.52406E+03	.26679	.473511	.37472	27524.3	28300.7	253.300	112.71	157.03	.14215E+00	722	1.68683
360.000	.8793E+01	.51112E+03	.26595	.432632	.32619	29092.0	29888.0	257.774	114.62	160.58	.17012E+00	676	1.66658
370.000	.8559E+01	.49749E+03	.26585	.393223	.28068	30693.7	31511.5	262.223	116.32	164.19	.20081E+00	629	1.64545
380.000	.8311E+01	.48304E+03	.26659	.355185	.23819	32329.4	33171.7	266.649	117.67	167.81	.23407E+00	582	1.62324
390.000	.8045E+01	.46760E+03	.26834	.318424	.19873	33998.2	34868.3	271.054	118.48	171.37	.26967E+00	536	1.59973
400.000	.7758E+01	.45090E+03	.27132	.282852	.16233	35696.7	36599.0	275.436	118.34	174.70	.30726E+00	489	1.57460
410.000	.7443E+01	.43261E+03	.27589	.248385	.12903	37416.3	38356.8	279.782	116.08	176.97	.34636E+00	443	1.54738
420.000	.7092E+01	.41219E+03	.28266	.214947	.09898	39131.7	40118.8	284.014	103.38	170.44	.38781E+00	403	1.51741
430.000	.6690E+01	.38884E+03	.29267	.182477	.07242	41208.6	42254.9	289.039	146.23	222.23	.42945E+00	331	1.48365
440.000	.6215E+01	.36126E+03	.30786	.150984	.04985	43397.1	44523.3	294.253	143.79	233.41	.47068E+00	284	1.44449
450.000	.5636E+01	.32758E+03	.33196	.120775	.03237	45712.7	46954.7	299.714	144.30	254.15	.51071E+00	238	1.39772
460.000	.4939E+01	.28707E+03	.37057	.093369	.02190	48192.0	49609.3	305.547	145.53	274.68	.54840E+00	203	0.00000
470.000	.4230E+01	.24589E+03	.42342	.072108	.01895	50704.8	52359.4	311.463	146.59	270.56	.58267E+00	187	0.00000
480.000	.3652E+01	.21228E+03	.48024	.057789	.01974	53057.4	54974.0	316.968	147.32	252.09	.61333E+00	183	0.00000
490.000	.3215E+01	.18690E+03	.53435	.048140	.02211	55223.9	57400.9	321.973	148.05	233.52	.64074E+00	186	0.00000
500.000	.2891E+01	.16806E+03	.58234	.041444	.02553	57234.7	59655.6	326.529	148.94	218.16	.66528E+00	193	0.00000
520.000	.2456E+01	.14272E+03	.65935	.032935	.03323	60960.5	63811.3	334.681	151.29	199.73	.70771E+00	209	0.00000
540.000	.2173E+01	.12633E+03	.71733	.027734	.04073	64489.9	67710.6	342.041	154.18	191.32	.74328E+00	224	0.00000
560.000	.1972E+01	.11460E+03	.76249	.024183	.04773	67945.1	71495.4	348.923	157.35	187.71	.77365E+00	238	0.00000
580.000	.1817E+01	.10564E+03	.79868	.021579	.05425	71383.8	75235.4	355.485	160.66	186.59	.79988E+00	251	0.00000
600.000	.1694E+01	.98461E+02	.82833	.019573	.06036	74836.0	78968.2	361.813	164.04	186.87	.82270E+00	262	0.00000
620.000	.1592E+01	.92527E+02	.85302	.017972	.06611	78318.4	82715.7	367.956	167.42	187.98	.84274E+00	272	0.00000
640.000	.1505E+01	.87499E+02	.87385	.016658	.07157	81841.0	86491.0	373.949	170.77	189.61	.86040E+00	281	0.00000
660.000	.1431E+01	.83158E+02	.89161	.015556	.07677	85409.6	90302.4	379.813	174.08	191.57	.87605E+00	290	0.00000
680.000	.1365E+01	.79352E+02	.90689	.014617	.08175	89027.8	94155.2	385.564	177.34	193.74	.88994E+00	298	0.00000
700.000	.1307E+01	.75976E+02	.92013	.013804	.08655	92697.6	98052.9	391.213	180.52	196.04	.90234E+00	306	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 7.5 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	Cv J/(mol•K)	Cp J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
136.112	.1269E+02	.73741E+03	.52236	2.116683	2.29778	46.2	637.4	133.878	88.73	117.10	.19196E-06	1741	2.04188
140.000	.1263E+02	.73384E+03	.51034	2.058989	2.23962	498.3	1092.4	137.172	88.24	116.85	.38291E-06	1722	2.03572
150.000	.1247E+02	.72466E+03	.48234	1.920141	2.09733	1657.1	2258.6	145.215	87.16	116.35	.18807E-05	1673	2.01991
160.000	.1231E+02	.71552E+03	.45797	1.793421	1.96432	2812.0	3421.2	152.715	86.36	116.10	.73878E-05	1625	2.00416
170.000	.1215E+02	.70640E+03	.43660	1.677122	1.83930	3965.9	4583.1	159.754	85.88	116.16	.24200E-04	1577	1.98846
180.000	.1200E+02	.69728E+03	.41774	1.569859	1.72125	5121.9	5747.1	166.403	85.74	116.55	.68254E-04	1529	1.97279
190.000	.1184E+02	.68815E+03	.40100	1.470496	1.60938	6283.0	6916.4	172.722	85.92	117.26	.16993E-03	1481	1.95714
200.000	.1168E+02	.67900E+03	.38608	1.378086	1.50305	7452.1	8094.1	178.761	86.42	118.28	.38089E-03	1434	1.94149
210.000	.1152E+02	.66981E+03	.37274	1.291835	1.40178	8632.2	9283.0	184.562	87.20	119.59	.78098E-03	1386	1.92583
220.000	.1136E+02	.66056E+03	.36078	1.211071	1.30515	9826.2	10486.2	190.161	88.24	121.17	.14838E-02	1338	1.91013
230.000	.1120E+02	.65125E+03	.35003	1.135218	1.21285	11036.8	11706.2	195.587	89.50	122.99	.26402E-02	1291	1.89437
240.000	.1104E+02	.64184E+03	.34037	1.063783	1.12462	12266.4	12945.6	200.864	90.95	125.02	.44383E-02	1243	1.87852
250.000	.1088E+02	.63232E+03	.33167	.996336	1.04024	13517.1	14206.5	206.012	92.55	127.24	.71006E-02	1195	1.86257
260.000	.1071E+02	.62268E+03	.32385	.932505	.95954	14790.7	15490.8	211.048	94.29	129.62	.10877E-01	1148	1.84647
270.000	.1054E+02	.61288E+03	.31684	.871965	.88240	16088.8	16800.1	215.986	96.14	132.14	.16036E-01	1101	1.83020
280.000	.1037E+02	.60290E+03	.31058	.814427	.80869	17412.7	18135.7	220.840	98.08	134.80	.22852E-01	1054	1.81373
290.000	.1020E+02	.59273E+03	.30502	.759640	.73834	18763.5	19498.9	225.618	100.09	137.59	.31591E-01	1007	1.79701
300.000	.1002E+02	.58232E+03	.30013	.707379	.67126	20142.0	20890.7	230.332	102.16	140.50	.42499E-01	960	1.78002
310.000	.9835E+01	.57164E+03	.29587	.657446	.60740	21549.2	22311.8	234.987	104.28	143.52	.55786E-01	914	1.76269
320.000	.9646E+01	.56065E+03	.29224	.609664	.54672	22985.8	23763.4	239.593	106.42	146.64	.71616E-01	867	1.74498
330.000	.9451E+01	.54932E+03	.28923	.563877	.48917	24452.6	25246.2	244.155	108.56	149.88	.90103E-01	821	1.72682
340.000	.9249E+01	.53758E+03	.28685	.519943	.43472	25950.4	26761.3	248.678	110.68	153.20	.11130E+00	775	1.70815
350.000	.9039E+01	.52538E+03	.28513	.477738	.38334	27479.9	28309.7	253.168	112.72	156.60	.13522E+00	729	1.68889
360.000	.8820E+01	.51263E+03	.28410	.437149	.33502	29041.9	29892.3	257.628	114.63	160.05	.16182E+00	683	1.66892
370.000	.8589E+01	.49924E+03	.28384	.398077	.28973	30636.6	31509.8	262.060	116.32	163.51	.19101E+00	638	1.64814
380.000	.8346E+01	.48510E+03	.28442	.360435	.24747	32263.7	33162.3	266.466	117.66	166.94	.22265E+00	592	1.62638
390.000	.8087E+01	.47006E+03	.28600	.324143	.20824	33921.5	34848.9	270.846	118.45	170.22	.25655E+00	547	1.60344
400.000	.7809E+01	.45389E+03	.28878	.289135	.17207	35605.7	36566.1	275.193	118.30	173.13	.29237E+00	501	1.57907
410.000	.7507E+01	.43634E+03	.29307	.255358	.13901	37306.0	38305.0	279.493	116.01	174.72	.32968E+00	457	1.55289
420.000	.7174E+01	.41700E+03	.29936	.222775	.10916	38994.1	40039.5	283.658	103.25	167.08	.36929E+00	420	1.52442
430.000	.6801E+01	.39529E+03	.30846	.191378	.08270	41030.2	42133.0	288.583	146.03	216.86	.40922E+00	350	1.49292
440.000	.6372E+01	.37038E+03	.32172	.161229	.06000	43153.7	44330.7	293.634	143.48	224.24	.44894E+00	306	1.45735
450.000	.5869E+01	.34115E+03	.34152	.132573	.04174	45362.0	46639.9	298.822	143.84	238.47	.48786E+00	263	1.41642
460.000	.5280E+01	.30687E+03	.37142	.106227	.02913	47688.6	49109.2	304.248	145.04	255.02	.52509E+00	226	0.00000
470.000	.4643E+01	.26987E+03	.41336	.084103	.02315	50089.0	51704.4	309.829	146.34	260.94	.55973E+00	203	0.00000
480.000	.4064E+01	.23622E+03	.46241	.067783	.02224	52425.8	54271.2	315.234	147.42	250.72	.59134E+00	194	0.00000
490.000	.3596E+01	.20900E+03	.51196	.056355	.02337	54623.4	56709.2	320.261	148.37	236.96	.61999E+00	193	0.00000
500.000	.3229E+01	.18767E+03	.55876	.048189	.02569	56689.8	59012.7	324.916	149.36	223.95	.64586E+00	196	0.00000
520.000	.2718E+01	.15800E+03	.63813	.037705	.03234	60524.5	63283.5	333.294	151.72	204.94	.69077E+00	209	0.00000
540.000	.2388E+01	.13880E+03	.69953	.031376	.03956	64131.3	67272.0	340.822	154.54	195.09	.72850E+00	223	0.00000
560.000	.2154E+01	.12522E+03	.74770	.027126	.04653	67640.2	71121.5	347.822	157.66	190.48	.76071E+00	237	0.00000
580.000	.1978E+01	.11496E+03	.78637	.024051	.05311	71117.8	74910.0	354.469	160.92	188.71	.78853E+00	249	0.00000
600.000	.1838E+01	.10682E+03	.81805	.021708	.05931	74599.5	78680.5	360.861	164.26	188.54	.81275E+00	260	0.00000
620.000	.1723E+01	.10015E+03	.84441	.019853	.06517	78105.1	82458.0	367.054	167.61	189.34	.83400E+00	271	0.00000
640.000	.1626E+01	.94528E+02	.86665	.018343	.07073	81646.4	86258.1	373.086	170.94	190.74	.85275E+00	280	0.00000
660.000	.1543E+01	.89703E+02	.88559	.017084	.07604	85230.5	90090.3	378.982	174.23	192.53	.86936E+00	289	0.00000
680.000	.1471E+01	.85492E+02	.90188	.016016	.08113	88861.7	93960.8	384.759	177.46	194.56	.88410E+00	298	0.00000
700.000	.1407E+01	.81771E+02	.91598	.015096	.08602	92542.6	97873.8	390.430	180.63	196.75	.89726E+00	306	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 8.0 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
136.195	.1269E+02	.73755E+03	.55674	2.117146	2.30197	49.4	679.8	133.900	88.74	117.08	.18919E-06	1742	2.04210
140.000	.1263E+02	.73406E+03	.54419	2.060743	2.24511	491.6	1125.0	137.122	88.27	116.83	.37140E-06	1723	2.03608
150.000	.1247E+02	.72490E+03	.51433	1.921986	2.10292	1649.7	2291.1	145.164	87.18	116.33	.18208E-05	1675	2.02030
160.000	.1231E+02	.71578E+03	.48833	1.795348	1.97002	2803.9	3453.6	152.663	86.38	116.08	.71408E-05	1627	2.00458
170.000	.1216E+02	.70667E+03	.46553	1.679126	1.84511	3957.2	4615.2	159.701	85.91	116.14	.23358E-04	1579	1.98890
180.000	.1200E+02	.69757E+03	.44540	1.571937	1.72718	5112.4	5779.0	166.348	85.76	116.52	.65795E-04	1531	1.97326
190.000	.1184E+02	.68846E+03	.42754	1.472645	1.61543	6272.6	6948.0	172.666	85.95	117.23	.16362E-03	1484	1.95765
200.000	.1169E+02	.67933E+03	.41162	1.380307	1.50924	7440.8	8125.3	178.703	86.44	118.24	.36639E-03	1436	1.94203
210.000	.1153E+02	.67017E+03	.39738	1.294130	1.40809	8620.0	9313.9	184.503	87.23	119.55	.75058E-03	1389	1.92641
220.000	.1137E+02	.66095E+03	.38461	1.213442	1.31160	9813.1	10516.6	190.100	88.26	121.12	.14249E-02	1341	1.91075
230.000	.1121E+02	.65166E+03	.37313	1.137668	1.21944	11022.5	11736.1	195.523	89.52	122.94	.25336E-02	1294	1.89504
240.000	.1105E+02	.64228E+03	.36281	1.066317	1.13135	12250.9	12974.9	200.797	90.97	124.96	.42564E-02	1246	1.87924
250.000	.1089E+02	.63280E+03	.35351	.998960	1.04711	13500.2	14235.1	205.942	92.58	127.16	.68056E-02	1199	1.86334
260.000	.1072E+02	.62319E+03	.34516	.935225	.96657	14772.4	15518.5	210.975	94.32	129.53	.10420E-01	1152	1.84731
270.000	.1055E+02	.61344E+03	.33766	.874788	.88957	16068.9	16826.9	215.910	96.16	132.04	.15355E-01	1105	1.83111
280.000	.1038E+02	.60352E+03	.33095	.817364	.81602	17391.0	18161.5	220.760	98.10	134.68	.21872E-01	1058	1.81472
290.000	.1021E+02	.59340E+03	.32499	.762701	.74583	18739.7	19523.4	225.534	100.11	137.45	.30225E-01	1011	1.79810
300.000	.1003E+02	.58306E+03	.31973	.710577	.67892	20116.0	20913.6	230.242	102.18	140.33	.40647E-01	965	1.78120
310.000	.9849E+01	.57246E+03	.31514	.660794	.61523	21520.7	22333.0	234.892	104.30	143.32	.53340E-01	919	1.76399
320.000	.9661E+01	.56156E+03	.31122	.613181	.55472	22954.3	23782.4	239.490	106.44	146.41	.68460E-01	873	1.74641
330.000	.9468E+01	.55033E+03	.30794	.567581	.49734	24417.8	25262.7	244.044	108.58	149.60	.86115E-01	827	1.72842
340.000	.9268E+01	.53872E+03	.30533	.523859	.44307	25911.6	26774.7	248.559	110.69	152.87	.10636E+00	782	1.70994
350.000	.9061E+01	.52667E+03	.30340	.481893	.39188	27436.5	28319.4	253.038	112.73	156.19	.12920E+00	736	1.69090
360.000	.8845E+01	.51410E+03	.30218	.441577	.34375	28993.0	29897.5	257.485	114.64	159.55	.15460E+00	691	1.67121
370.000	.8618E+01	.50094E+03	.30173	.402819	.29866	30581.1	31509.4	261.902	116.32	162.88	.18248E+00	646	1.65075
380.000	.8380E+01	.48709E+03	.30215	.365540	.25661	32200.2	33154.8	266.289	117.66	166.13	.21272E+00	601	1.62941
390.000	.8127E+01	.47240E+03	.30355	.329672	.21759	33847.9	34832.2	270.645	118.44	169.17	.24513E+00	557	1.60699
400.000	.7858E+01	.45672E+03	.30613	.295165	.18163	35519.2	36537.3	274.961	118.26	171.73	.27941E+00	513	1.58330
410.000	.7567E+01	.43982E+03	.31014	.261984	.14876	37202.5	38259.7	279.220	115.95	172.79	.31515E+00	470	1.55804
420.000	.7250E+01	.42138E+03	.31600	.230116	.11907	38867.4	39970.9	283.330	103.15	164.29	.35315E+00	435	1.53083
430.000	.6899E+01	.40100E+03	.32434	.199581	.09269	40870.5	42030.1	288.174	145.87	212.66	.39155E+00	367	1.50114
440.000	.6505E+01	.37810E+03	.33617	.170456	.06987	42945.0	44174.8	293.104	143.24	217.63	.42991E+00	325	1.46829
450.000	.6055E+01	.35196E+03	.35311	.142943	.05108	45078.5	46399.6	298.102	143.50	227.96	.46774E+00	284	1.43145
460.000	.5541E+01	.32207E+03	.37749	.117547	.03709	47298.7	48742.5	303.250	144.63	240.67	.50431E+00	248	0.00000
470.000	.4977E+01	.28930E+03	.41131	.095369	.02873	49592.7	51200.1	308.535	146.02	249.35	.53888E+00	221	0.00000
480.000	.4425E+01	.25721E+03	.45298	.077749	.02566	51882.1	53689.9	313.778	147.32	246.69	.57098E+00	207	0.00000
490.000	.3947E+01	.22943E+03	.49746	.064782	.02573	54082.6	56109.3	318.766	148.49	236.72	.60047E+00	202	0.00000
500.000	.3556E+01	.20669E+03	.54115	.055303	.02706	56175.1	58424.8	323.445	149.62	226.50	.62735E+00	202	0.00000
520.000	.2985E+01	.17352E+03	.61981	.042836	.03224	60092.1	62771.9	331.973	152.07	209.20	.67442E+00	210	0.00000
540.000	.2607E+01	.15156E+03	.68334	.035282	.03889	63771.1	66839.2	339.649	154.87	198.60	.71416E+00	223	0.00000
560.000	.2341E+01	.13607E+03	.73394	.030259	.04568	67333.1	70750.4	346.762	157.94	193.18	.74811E+00	236	0.00000
580.000	.2141E+01	.12445E+03	.77478	.026665	.05223	70850.0	74586.4	353.492	161.17	190.80	.77746E+00	248	0.00000
600.000	.1984E+01	.11531E+03	.80831	.023952	.05847	74361.7	78394.1	359.947	164.47	190.20	.80302E+00	260	0.00000
620.000	.1856E+01	.10787E+03	.83624	.021822	.06439	77890.9	82201.7	366.189	167.79	190.70	.82547E+00	270	0.00000
640.000	.1749E+01	.10163E+03	.85980	.020098	.07004	81451.2	86026.4	372.261	171.10	191.87	.84527E+00	280	0.00000
660.000	.1657E+01	.96305E+02	.87987	.018670	.07543	85051.1	89879.4	378.188	174.37	193.48	.86282E+00	289	0.00000
680.000	.1577E+01	.91676E+02	.89712	.017464	.08061	88695.5	93767.7	383.992	177.59	195.38	.87840E+00	297	0.00000
700.000	.1507E+01	.87598E+02	.91205	.016430	.08559	92387.7	97695.9	389.686	180.75	197.47	.89231E+00	305	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 8.5 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
136.278	.1269E+02	.73770E+03	.59107	2.117611	2.30617	52.5	722.2	133.922	88.76	117.06	.18718E-06	1744	2.04231
140.000	.1263E+02	.73428E+03	.57803	2.062497	2.25059	484.8	1157.7	137.073	88.29	116.82	.36164E-06	1725	2.03644
150.000	.1248E+02	.72514E+03	.54630	1.923829	2.10851	1642.3	2323.6	145.114	87.21	116.31	.17697E-05	1676	2.02068
160.000	.1232E+02	.71603E+03	.51867	1.797272	1.97572	2795.9	3485.9	152.611	86.41	116.06	.69290E-05	1629	2.00499
170.000	.1216E+02	.70694E+03	.49443	1.681126	1.85092	3948.4	4647.3	159.648	85.93	116.12	.22633E-04	1581	1.98934
180.000	.1201E+02	.69786E+03	.47304	1.574010	1.73311	5102.9	5810.9	166.294	85.79	116.50	.63673E-04	1534	1.97373
190.000	.1185E+02	.68877E+03	.45406	1.474789	1.62148	6262.3	6979.6	172.610	85.97	117.20	.15817E-03	1486	1.95815
200.000	.1169E+02	.67966E+03	.43714	1.382523	1.51541	7429.7	8156.6	178.646	86.47	118.21	.35383E-03	1439	1.94257
210.000	.1154E+02	.67052E+03	.42200	1.296418	1.41440	8608.0	9344.8	184.443	87.25	119.51	.72419E-03	1391	1.92699
220.000	.1138E+02	.66133E+03	.40841	1.215805	1.31804	9800.0	10547.0	190.038	88.29	121.08	.13737E-02	1344	1.91137
230.000	.1122E+02	.65207E+03	.39621	1.140110	1.22601	11008.4	11766.0	195.459	89.55	122.88	.24408E-02	1297	1.89570
240.000	.1106E+02	.64272E+03	.38522	1.068840	1.13806	12235.5	13004.2	200.731	90.99	124.89	.40979E-02	1249	1.87996
250.000	.1090E+02	.63328E+03	.37532	1.001571	1.05397	13483.5	14263.7	205.873	92.60	127.09	.65483E-02	1202	1.86412
260.000	.1073E+02	.62371E+03	.36642	.937931	.97357	14754.3	15546.4	210.903	94.34	129.44	.10021E-01	1155	1.84814
270.000	.1056E+02	.61400E+03	.35843	.877596	.89673	16049.2	16853.8	215.834	96.19	131.94	.14759E-01	1109	1.83202
280.000	.1039E+02	.60413E+03	.35128	.820282	.82333	17369.5	18187.3	220.680	98.13	134.57	.21015E-01	1062	1.81570
290.000	.1022E+02	.59407E+03	.34491	.765739	.75329	18716.3	19547.9	225.450	100.14	137.31	.29030E-01	1016	1.79917
300.000	.1004E+02	.58379E+03	.33928	.713747	.68653	20090.4	20936.7	230.153	102.21	140.17	.39028E-01	970	1.78237
310.000	.9863E+01	.57326E+03	.33437	.664111	.62301	21492.5	22354.3	234.797	104.32	143.13	.51200E-01	924	1.76528
320.000	.9677E+01	.56246E+03	.33014	.616660	.56266	22923.3	23801.7	239.389	106.46	146.19	.65698E-01	879	1.74783
330.000	.9485E+01	.55133E+03	.32660	.571240	.50546	24383.4	25279.6	243.936	108.60	149.33	.82623E-01	833	1.72999
340.000	.9288E+01	.53984E+03	.32374	.527720	.45136	25873.5	26788.7	248.441	110.71	152.55	.10203E+00	788	1.71169
350.000	.9083E+01	.52793E+03	.32159	.485981	.40035	27394.0	28329.9	252.910	112.75	155.81	.12393E+00	743	1.69287
360.000	.8870E+01	.51554E+03	.32017	.445922	.35240	28945.3	29903.6	257.345	114.65	159.07	.14828E+00	699	1.67343
370.000	.8647E+01	.50259E+03	.31954	.407456	.30750	30527.2	31510.2	261.748	116.33	162.29	.17501E+00	654	1.65329
380.000	.8413E+01	.48900E+03	.31978	.370511	.26563	32138.7	33149.0	266.117	117.65	165.39	.20402E+00	611	1.63233
390.000	.8166E+01	.47465E+03	.32100	.335030	.22680	33777.1	34818.0	270.451	118.42	168.22	.23512E+00	567	1.61040
400.000	.7904E+01	.45941E+03	.32336	.300970	.19102	35436.7	36512.1	274.740	118.23	170.47	.26804E+00	524	1.58732
410.000	.7623E+01	.44307E+03	.32710	.268311	.15831	37104.9	38219.9	278.963	115.89	171.10	.30239E+00	483	1.56287
420.000	.7319E+01	.42542E+03	.33256	.237051	.12874	38749.8	39911.2	283.024	103.07	161.94	.33898E+00	449	1.53674
430.000	.6987E+01	.40613E+03	.34026	.207224	.10241	40725.5	41942.0	287.801	145.74	209.27	.37602E+00	383	1.50856
440.000	.6620E+01	.38480E+03	.35096	.178910	.07950	42761.3	44045.3	292.636	143.05	212.59	.41314E+00	343	1.47784
450.000	.6210E+01	.36096E+03	.36582	.152273	.06031	44839.2	46207.9	297.494	143.24	220.42	.44992E+00	304	1.44404
460.000	.5750E+01	.33424E+03	.38648	.127656	.04536	46982.5	48460.6	302.445	144.31	230.29	.48576E+00	269	0.00000
470.000	.5248E+01	.30501E+03	.41450	.105730	.03526	49189.8	50809.6	307.497	145.71	238.80	.52003E+00	240	0.00000
480.000	.4735E+01	.27523E+03	.44978	.087436	.03012	51418.8	53213.9	312.559	147.14	240.62	.55230E+00	221	0.00000
490.000	.4264E+01	.24785E+03	.48929	.073237	.02875	53602.9	55596.3	317.471	148.48	234.97	.58229E+00	213	0.00000
500.000	.3862E+01	.22447E+03	.52944	.062579	.02934	55704.0	57905.0	322.136	149.75	226.74	.60993E+00	210	0.00000
520.000	.3250E+01	.18888E+03	.60498	.048252	.03299	59672.9	62288.6	330.734	152.33	212.11	.65877E+00	214	0.00000
540.000	.2829E+01	.16445E+03	.66914	.039427	.03879	63413.7	66418.0	338.528	155.15	201.66	.70029E+00	224	0.00000
560.000	.2530E+01	.14708E+03	.72144	.033574	.04522	67026.2	70385.3	345.743	158.20	195.70	.73587E+00	236	0.00000
580.000	.2307E+01	.13408E+03	.76407	.029418	.05164	70581.8	74266.5	352.553	161.39	192.81	.76668E+00	248	0.00000
600.000	.2132E+01	.12391E+03	.79923	.026305	.05785	74123.4	78110.5	359.069	164.67	191.83	.79354E+00	259	0.00000
620.000	.1990E+01	.11567E+03	.82857	.023877	.06380	77676.3	81947.6	365.360	167.96	192.03	.81713E+00	270	0.00000
640.000	.1872E+01	.10880E+03	.85335	.021924	.06950	81255.8	85796.7	371.470	171.25	192.98	.83796E+00	279	0.00000
660.000	.1771E+01	.10296E+03	.87447	.020314	.07495	84871.5	89670.2	377.429	174.50	194.43	.85642E+00	288	0.00000
680.000	.1684E+01	.97895E+02	.89263	.018961	.08020	88529.3	93576.1	383.259	177.71	196.20	.87283E+00	297	0.00000
700.000	.1608E+01	.93452E+02	.90835	.017805	.08525	92232.9	97519.6	388.975	180.86	198.18	.88748E+00	305	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 9.0 MPa

Temp. K	Density mol/L	Density kg/m^3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m^3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
136.361	.1269E+02	.73784E+03	.62534	2.118078	2.31036	55.7	764.7	133.944	88.77	117.04	.18582E-06	1745	2.04253
140.000	.1264E+02	.73450E+03	.61185	2.064249	2.25607	478.1	1190.3	137.023	88.32	116.81	.35336E-06	1727	2.03679
150.000	.1248E+02	.72538E+03	.57824	1.925670	2.11409	1635.0	2356.2	145.064	87.23	116.30	.17259E-05	1678	2.02106
160.000	.1232E+02	.71628E+03	.54898	1.799194	1.98141	2787.9	3518.2	152.560	86.43	116.05	.67467E-05	1631	2.00539
170.000	.1217E+02	.70721E+03	.52332	1.683123	1.85672	3939.8	4679.4	159.595	85.95	116.10	.22006E-04	1583	1.98978
180.000	.1201E+02	.69815E+03	.50066	1.576079	1.73902	5093.5	5842.8	166.240	85.81	116.47	.61832E-04	1536	1.97420
190.000	.1186E+02	.68908E+03	.48055	1.476929	1.62752	6252.1	7011.2	172.554	85.99	117.17	.15342E-03	1489	1.95865
200.000	.1170E+02	.67999E+03	.46263	1.384733	1.52157	7418.6	8187.9	178.588	86.49	118.17	.34287E-03	1441	1.94311
210.000	.1154E+02	.67087E+03	.44659	1.298700	1.42069	8595.9	9375.7	184.384	87.27	119.47	.70114E-03	1394	1.92756
220.000	.1138E+02	.66171E+03	.43219	1.218160	1.32446	9786.9	10577.5	189.977	88.31	121.03	.13290E-02	1347	1.91199
230.000	.1123E+02	.65247E+03	.41925	1.142542	1.23257	10994.3	11796.0	195.396	89.57	122.83	.23596E-02	1300	1.89636
240.000	.1107E+02	.64316E+03	.40760	1.071354	1.14476	12220.2	13033.6	200.665	91.02	124.83	.39589E-02	1253	1.88067
250.000	.1090E+02	.63375E+03	.39711	1.004170	1.06081	13467.0	14292.4	205.804	92.62	127.01	.63225E-02	1206	1.86488
260.000	.1074E+02	.62422E+03	.38766	.940622	.98055	14736.3	15574.3	210.831	94.36	129.36	.96700E-02	1159	1.84897
270.000	.1057E+02	.61456E+03	.37917	.880387	.90385	16029.6	16880.8	215.759	96.21	131.84	.14236E-01	1112	1.83291
280.000	.1040E+02	.60473E+03	.37157	.823181	.83060	17348.2	18213.2	220.601	98.15	134.45	.20262E-01	1066	1.81668
290.000	.1023E+02	.59473E+03	.36479	.768756	.76072	18693.0	19572.6	225.366	100.16	137.18	.27979E-01	1020	1.80023
300.000	.1006E+02	.58451E+03	.35880	.716892	.69412	20065.0	20959.9	230.064	102.23	140.02	.37602E-01	975	1.78353
310.000	.9876E+01	.57406E+03	.35354	.667397	.63075	21464.6	22375.9	234.703	104.34	142.95	.49316E-01	929	1.76655
320.000	.9692E+01	.56334E+03	.34901	.620102	.57056	22892.7	23821.3	239.289	106.48	145.97	.63263E-01	884	1.74923
330.000	.9502E+01	.55231E+03	.34520	.574855	.51352	24349.6	25296.8	243.828	108.61	149.08	.79545E-01	839	1.73154
340.000	.9307E+01	.54094E+03	.34209	.531527	.45959	25836.1	26803.1	248.326	110.72	152.24	.98212E-01	794	1.71342
350.000	.9104E+01	.52916E+03	.33971	.490004	.40875	27352.3	28340.9	252.785	112.76	155.44	.11927E+00	750	1.69480
360.000	.8894E+01	.51694E+03	.33808	.450187	.36097	28898.6	29910.6	257.208	114.66	158.62	.14270E+00	706	1.67561
370.000	.8674E+01	.50420E+03	.33726	.411995	.31624	30474.6	31512.2	261.597	116.33	161.74	.16842E+00	663	1.65576
380.000	.8445E+01	.49085E+03	.33731	.375360	.27454	32079.1	33144.8	265.950	117.65	164.70	.19634E+00	619	1.63516
390.000	.8203E+01	.47682E+03	.33834	.340231	.23588	33708.9	34806.0	270.263	118.41	167.34	.22628E+00	577	1.61367
400.000	.7948E+01	.46196E+03	.34049	.306574	.20025	35357.7	36490.1	274.527	118.21	169.34	.25799E+00	535	1.59116
410.000	.7676E+01	.44614E+03	.34396	.274375	.16768	37012.4	38184.9	278.718	115.85	169.60	.29112E+00	495	1.56743
420.000	.7384E+01	.42917E+03	.34905	.243640	.13821	38639.8	39858.8	282.737	103.00	159.92	.32644E+00	463	1.54225
430.000	.7068E+01	.41080E+03	.35618	.214407	.11191	40592.4	41865.8	287.459	145.63	206.47	.36227E+00	398	1.51534
440.000	.6723E+01	.39074E+03	.36595	.186752	.08890	42596.7	43935.4	292.216	142.89	208.60	.39826E+00	360	1.48634
450.000	.6343E+01	.36868E+03	.37923	.160809	.06940	44631.2	46050.1	296.967	143.03	214.73	.43406E+00	322	1.45492
460.000	.5924E+01	.34436E+03	.39719	.136824	.05375	46716.6	48235.8	301.770	144.05	222.58	.46916E+00	288	0.00000
470.000	.5470E+01	.31794E+03	.42104	.115229	.04237	48855.6	50500.9	306.641	145.44	230.13	.50300E+00	258	0.00000
480.000	.4999E+01	.29054E+03	.45115	.096654	.03549	51025.3	52825.8	311.536	146.93	233.94	.53521E+00	237	0.00000
490.000	.4546E+01	.26422E+03	.48596	.081592	.03253	53179.7	55159.6	316.348	148.39	231.88	.56548E+00	225	0.00000
500.000	.4142E+01	.24077E+03	.52264	.069897	.03214	55277.9	57450.6	320.977	149.78	225.98	.59362E+00	220	0.00000
520.000	.3505E+01	.20372E+03	.59392	.053857	.03454	59275.1	61842.9	329.592	152.51	213.66	.64386E+00	219	0.00000
540.000	.3050E+01	.17727E+03	.65725	.043778	.03930	63063.9	66014.9	337.466	155.38	204.08	.68694E+00	227	0.00000
560.000	.2721E+01	.15815E+03	.71042	.037059	.04520	66721.9	70029.7	344.767	158.42	197.96	.72403E+00	237	0.00000
580.000	.2474E+01	.14380E+03	.75438	.032304	.05138	70314.5	73952.4	351.650	161.60	194.71	.75621E+00	248	0.00000
600.000	.2281E+01	.13259E+03	.79088	.028762	.05749	73885.5	77830.9	358.225	164.85	193.39	.78430E+00	259	0.00000
620.000	.2125E+01	.12353E+03	.82147	.026016	.06342	77461.9	81696.5	364.563	168.13	193.33	.80901E+00	270	0.00000
640.000	.1996E+01	.11602E+03	.84735	.023819	.06913	81060.6	85569.6	370.711	171.40	194.08	.83083E+00	279	0.00000
660.000	.1886E+01	.10964E+03	.86944	.022016	.07462	84692.1	89463.3	376.701	174.64	195.36	.85019E+00	288	0.00000
680.000	.1792E+01	.10414E+03	.88845	.020506	.07991	88363.3	93386.5	382.557	177.83	197.00	.86739E+00	297	0.00000
700.000	.1709E+01	.99326E+02	.90491	.019221	.08502	92078.3	97345.0	388.294	180.96	198.88	.88276E+00	305	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 10 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
136.527	.1270E+02	.73812E+03	.69371	2.119021	2.31874	62.0	849.5	133.989	88.80	117.01	.18473E-06	1747	2.04296
140.000	.1264E+02	.73495E+03	.67942	2.067750	2.26702	464.8	1255.7	136.925	88.37	116.78	.34039E-06	1730	2.03750
150.000	.1249E+02	.72585E+03	.64207	1.929346	2.12524	1620.4	2421.2	144.963	87.28	116.27	.16564E-05	1682	2.02182
160.000	.1233E+02	.71679E+03	.60955	1.803030	1.99277	2772.0	3582.9	152.457	86.48	116.01	.64538E-05	1634	2.00621
170.000	.1218E+02	.70775E+03	.58102	1.687107	1.86830	3922.5	4743.7	159.490	86.00	116.05	.20991E-04	1587	1.99065
180.000	.1202E+02	.69872E+03	.55583	1.580205	1.75083	5074.7	5906.6	166.132	85.86	116.42	.58831E-04	1540	1.97513
190.000	.1187E+02	.68969E+03	.53347	1.481194	1.63956	6231.8	7074.5	172.443	86.04	117.11	.14565E-03	1493	1.95964
200.000	.1171E+02	.68065E+03	.51353	1.389137	1.53386	7396.6	8250.5	178.474	86.54	118.10	.32485E-03	1446	1.94417
210.000	.1155E+02	.67157E+03	.49569	1.303244	1.43323	8572.1	9437.6	184.267	87.32	119.39	.66311E-03	1399	1.92870
220.000	.1140E+02	.66246E+03	.47967	1.222848	1.33727	9761.1	10638.5	189.855	88.35	120.94	.12549E-02	1352	1.91321
230.000	.1124E+02	.65328E+03	.46526	1.147380	1.24564	10966.3	11856.0	195.270	89.61	122.72	.22248E-02	1306	1.89768
240.000	.1108E+02	.64403E+03	.45228	1.076350	1.15810	12190.0	13092.5	200.534	91.06	124.71	.37279E-02	1259	1.88208
250.000	.1092E+02	.63469E+03	.44058	1.009334	1.07442	13434.2	14350.0	205.668	92.67	126.87	.59468E-02	1212	1.86640
260.000	.1076E+02	.62523E+03	.43004	.945965	.99445	14700.7	15630.3	210.689	94.41	129.19	.90858E-02	1166	1.85061
270.000	.1059E+02	.61565E+03	.42055	.885921	.91803	15991.0	16935.1	215.610	96.25	131.65	.13364E-01	1120	1.83469
280.000	.1042E+02	.60593E+03	.41204	.828923	.84507	17306.2	18265.5	220.444	98.19	134.23	.19003E-01	1074	1.81860
290.000	.1025E+02	.59603E+03	.40444	.774723	.77548	18647.3	19622.5	225.202	100.20	136.92	.26221E-01	1029	1.80232
300.000	.1008E+02	.58594E+03	.39769	.723106	.70918	20015.0	21007.0	229.890	102.27	139.72	.35217E-01	984	1.78581
310.000	.9903E+01	.57563E+03	.39176	.673881	.64611	21410.0	22419.7	234.518	104.38	142.60	.46160E-01	939	1.76904
320.000	.9722E+01	.56507E+03	.38661	.626880	.58622	22832.7	23861.3	239.092	106.51	145.56	.59185E-01	895	1.75198
330.000	.9535E+01	.55423E+03	.38222	.581960	.52949	24283.6	25332.3	243.618	108.65	148.59	.74384E-01	850	1.73457
340.000	.9343E+01	.54307E+03	.37860	.538992	.47587	25763.1	26833.4	248.099	110.76	151.66	.91808E-01	807	1.71678
350.000	.9145E+01	.53156E+03	.37575	.497869	.42534	27271.4	28364.8	252.540	112.79	154.75	.11147E+00	763	1.69854
360.000	.8940E+01	.51965E+03	.37369	.458497	.37787	28808.4	29926.9	256.942	114.68	157.79	.13333E+00	721	1.67981
370.000	.8727E+01	.50728E+03	.37246	.420801	.33344	30373.5	31519.3	261.306	116.34	160.73	.15735E+00	678	1.66051
380.000	.8506E+01	.49438E+03	.37211	.384721	.29205	31965.0	33140.7	265.629	117.65	163.45	.18343E+00	636	1.64056
390.000	.8274E+01	.48090E+03	.37273	.350214	.25367	33579.2	34787.9	269.906	118.39	165.79	.21142E+00	595	1.61988
400.000	.8030E+01	.46674E+03	.37444	.317253	.21831	35209.2	36454.5	274.125	118.17	167.37	.24110E+00	556	1.59835
410.000	.7773E+01	.45180E+03	.37739	.285830	.18595	36840.5	38127.0	278.261	115.78	167.07	.27215E+00	518	1.57586
420.000	.7500E+01	.43596E+03	.38179	.255957	.15662	38438.6	39771.9	282.211	102.88	156.61	.30532E+00	488	1.55226
430.000	.7210E+01	.41906E+03	.38795	.227668	.13035	40353.6	41740.6	286.842	145.47	202.06	.33907E+00	425	1.52738
440.000	.6898E+01	.40097E+03	.39624	.201022	.10717	42309.3	43758.9	291.481	142.66	202.64	.37311E+00	390	1.50105
450.000	.6563E+01	.38150E+03	.40721	.176110	.08718	44280.2	45803.8	296.075	142.72	206.65	.40717E+00	355	1.47310
460.000	.6203E+01	.36055E+03	.42151	.153067	.07053	46284.1	47896.2	300.673	143.66	211.99	.44083E+00	322	0.00000
470.000	.5818E+01	.33816E+03	.43985	.132097	.05742	48325.7	50044.5	305.294	145.01	217.61	.47368E+00	293	0.00000
480.000	.5415E+01	.31476E+03	.46270	.113485	.04802	50397.9	52244.6	309.926	146.54	222.08	.50541E+00	269	0.00000
490.000	.5011E+01	.29128E+03	.48979	.097534	.04222	52481.1	54476.6	314.528	148.12	223.76	.53573E+00	252	0.00000
500.000	.4627E+01	.26896E+03	.51984	.084366	.03945	54547.5	56708.6	319.037	149.67	222.16	.56437E+00	241	0.00000
520.000	.3973E+01	.23093E+03	.58215	.065308	.03934	58558.3	61075.3	327.602	152.68	214.13	.61646E+00	234	0.00000
540.000	.3475E+01	.20196E+03	.64102	.052906	.04213	62403.5	65281.5	335.540	155.69	206.82	.66198E+00	236	0.00000
560.000	.3097E+01	.18002E+03	.69346	.044450	.04658	66131.5	69360.3	342.957	158.78	201.38	.70163E+00	243	0.00000
580.000	.2808E+01	.16320E+03	.73854	.038434	.05194	69788.9	73350.5	349.959	161.95	197.95	.73627E+00	251	0.00000
600.000	.2581E+01	.14999E+03	.77679	.033971	.05762	73414.6	77289.8	356.636	165.18	196.23	.76664E+00	261	0.00000
620.000	.2397E+01	.13933E+03	.80925	.030535	.06333	77036.2	81207.8	363.060	168.43	195.76	.79343E+00	271	0.00000
640.000	.2245E+01	.13051E+03	.83692	.027806	.06895	80672.3	85125.8	369.279	171.67	196.16	.81713E+00	280	0.00000
660.000	.2117E+01	.12307E+03	.86064	.025584	.07443	84335.2	89058.1	375.329	174.88	197.15	.83819E+00	289	0.00000
680.000	.2007E+01	.11668E+03	.88111	.023736	.07975	88033.0	93014.7	381.235	178.05	198.56	.85694E+00	298	0.00000
700.000	.1911E+01	.11110E+03	.89889	.022173	.08491	91770.7	97002.4	387.015	181.16	200.25	.87369E+00	306	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 11 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
136.692	.1270E+02	.73840E+03	.76187	2.119975	2.32712	68.4	934.3	134.033	88.83	116.97	.18544E-06	1750	2.04339
140.000	.1265E+02	.73539E+03	.74691	2.071246	2.27796	451.6	1321.0	136.827	88.41	116.75	.33119E-06	1734	2.03821
150.000	.1250E+02	.72632E+03	.70583	1.933015	2.13637	1606.0	2486.3	144.863	87.33	116.23	.16056E-05	1686	2.02258
160.000	.1234E+02	.71729E+03	.67004	1.806855	2.00410	2756.3	3647.7	152.355	86.53	115.97	.62358E-05	1638	2.00702
170.000	.1219E+02	.70828E+03	.63865	1.691079	1.87985	3905.4	4808.1	159.385	86.05	116.01	.20224E-04	1592	1.99151
180.000	.1203E+02	.69929E+03	.61092	1.584316	1.76261	5056.2	5970.5	166.025	85.90	116.37	.56538E-04	1545	1.97605
190.000	.1188E+02	.69030E+03	.58630	1.485441	1.65157	6211.6	7137.9	172.333	86.09	117.05	.13966E-03	1498	1.96063
200.000	.1172E+02	.68130E+03	.56435	1.393518	1.54611	7374.8	8313.2	178.361	86.58	118.04	.31088E-03	1451	1.94523
210.000	.1157E+02	.67227E+03	.54469	1.307762	1.44573	8548.5	9499.6	184.150	87.36	119.31	.63345E-03	1405	1.92983
220.000	.1141E+02	.66320E+03	.52704	1.227506	1.35002	9735.6	10699.7	189.735	88.40	120.85	.11968E-02	1358	1.91442
230.000	.1125E+02	.65408E+03	.51116	1.152184	1.25865	10938.7	11916.2	195.145	89.66	122.62	.21188E-02	1311	1.89898
240.000	.1109E+02	.64489E+03	.49684	1.081306	1.17137	12160.1	13151.6	200.404	91.11	124.59	.35457E-02	1265	1.88348
250.000	.1094E+02	.63561E+03	.48393	1.014451	1.08796	13401.9	14407.8	205.533	92.71	126.73	.56495E-02	1219	1.86790
260.000	.1077E+02	.62623E+03	.47229	.951254	1.00825	14665.7	15686.7	210.548	94.45	129.03	.86224E-02	1173	1.85223
270.000	.1061E+02	.61674E+03	.46180	.891394	.93212	15953.0	16989.7	215.463	96.30	131.47	.12670E-01	1128	1.83643
280.000	.1044E+02	.60710E+03	.45237	.834594	.85944	17265.0	18318.1	220.290	98.23	134.02	.18002E-01	1082	1.82049
290.000	.1028E+02	.59731E+03	.44393	.780608	.79012	18602.4	19672.9	225.039	100.24	136.68	.24820E-01	1037	1.80437
300.000	.1010E+02	.58733E+03	.43642	.729223	.72410	19966.1	21054.7	229.719	102.31	139.43	.33313E-01	993	1.78804
310.000	.9930E+01	.57716E+03	.42979	.680250	.66131	21356.6	22464.4	234.337	104.42	142.27	.43638E-01	949	1.77148
320.000	.9751E+01	.56675E+03	.42401	.633525	.60171	22774.3	23902.4	238.900	106.55	145.18	.55922E-01	905	1.75465
330.000	.9567E+01	.55609E+03	.41904	.588906	.54526	24219.5	25369.2	243.412	108.69	148.14	.70252E-01	862	1.73751
340.000	.9379E+01	.54514E+03	.41488	.546269	.49193	25692.5	26865.3	247.879	110.79	151.13	.86676E-01	819	1.72002
350.000	.9185E+01	.53387E+03	.41154	.505509	.44168	27193.4	28391.0	252.303	112.82	154.11	.10520E+00	776	1.70215
360.000	.8985E+01	.52224E+03	.40902	.466536	.39448	28721.9	29946.2	256.686	114.70	157.03	.12581E+00	734	1.68383
370.000	.8778E+01	.51020E+03	.40735	.429280	.35033	30277.1	31530.2	261.027	116.36	159.82	.14846E+00	693	1.66502
380.000	.8563E+01	.49771E+03	.40659	.393683	.30918	31857.0	33141.6	265.323	117.65	162.35	.17305E+00	653	1.64566
390.000	.8339E+01	.48471E+03	.40678	.359706	.27104	33457.6	34776.7	269.568	118.38	164.44	.19947E+00	613	1.62568
400.000	.8106E+01	.47115E+03	.40804	.327326	.23588	35071.3	36428.4	273.750	118.14	165.72	.22750E+00	575	1.60500
410.000	.7861E+01	.45694E+03	.41046	.296533	.20368	36683.1	38082.4	277.840	115.73	165.00	.25687E+00	538	1.58354
420.000	.7604E+01	.44200E+03	.41423	.267339	.17444	38257.4	39703.9	281.734	102.80	154.00	.28829E+00	511	1.56121
430.000	.7333E+01	.42625E+03	.41954	.239767	.14815	40143.2	41643.1	286.295	145.35	198.73	.32033E+00	450	1.53791
440.000	.7047E+01	.40960E+03	.42668	.213861	.12481	42062.5	43623.5	290.848	142.50	198.36	.35275E+00	416	1.51355
450.000	.6743E+01	.39196E+03	.43597	.189678	.10445	43988.5	45619.7	295.332	142.50	201.14	.38532E+00	383	1.48805
460.000	.6422E+01	.37328E+03	.44784	.167296	.08712	45937.0	47649.9	299.793	143.40	205.05	.41770E+00	352	0.00000
470.000	.6083E+01	.35358E+03	.46273	.146817	.07288	47913.6	49721.8	304.250	144.71	209.34	.44953E+00	324	0.00000
480.000	.5731E+01	.33309E+03	.48096	.128376	.06181	49916.0	51835.5	308.700	146.23	213.28	.48058E+00	300	0.00000
490.000	.5372E+01	.31225E+03	.50260	.112122	.05391	51935.5	53983.1	313.128	147.85	215.96	.51058E+00	280	0.00000
500.000	.5019E+01	.29175E+03	.52714	.098160	.04894	53956.7	56148.2	317.502	149.48	216.70	.53928E+00	266	0.00000
520.000	.4380E+01	.25460E+03	.58084	.076796	.04557	57942.8	60454.0	325.947	152.69	213.04	.59232E+00	252	0.00000
540.000	.3863E+01	.22453E+03	.63424	.062308	.04681	61810.6	64658.3	333.881	155.85	207.49	.63947E+00	249	0.00000
560.000	.3455E+01	.20084E+03	.68371	.052227	.04978	65579.8	68763.3	341.346	159.01	203.23	.68109E+00	252	0.00000
580.000	.3133E+01	.18213E+03	.72797	.044948	.05400	69285.3	72795.9	348.422	162.22	200.24	.71777E+00	258	0.00000
600.000	.2876E+01	.16718E+03	.76662	.039520	.05895	72956.9	76781.4	355.178	165.44	198.50	.75013E+00	265	0.00000
620.000	.2667E+01	.15503E+03	.80002	.035344	.06422	76619.1	80743.2	361.673	168.68	197.84	.77879E+00	274	0.00000
640.000	.2494E+01	.14497E+03	.82883	.032039	.06959	80290.2	84700.6	367.955	171.90	198.02	.80422E+00	283	0.00000
660.000	.2348E+01	.13647E+03	.85373	.029361	.07492	83983.0	88667.9	374.059	175.10	198.80	.82686E+00	291	0.00000
680.000	.2223E+01	.12919E+03	.87534	.027144	.08017	87706.4	92655.4	380.011	178.25	200.01	.84705E+00	299	0.00000
700.000	.2114E+01	.12286E+03	.89416	.025278	.08531	91466.4	96670.6	385.830	181.35	201.54	.86512E+00	307	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 12 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
136.857	.1271E+02	.73868E+03	.82982	2.120938	2.33550	74.8	1019.0	134.077	88.85	116.93	.18765E-06	1753	2.04382
140.000	.1266E+02	.73582E+03	.81433	2.074736	2.28888	438.5	1386.4	136.730	88.46	116.73	.32492E-06	1737	2.03891
150.000	.1250E+02	.72678E+03	.76950	1.936676	2.14748	1591.6	2551.3	144.764	87.37	116.20	.15693E-05	1689	2.02333
160.000	.1235E+02	.71778E+03	.73045	1.810671	2.01542	2740.7	3712.4	152.253	86.57	115.94	.60750E-05	1642	2.00782
170.000	.1219E+02	.70881E+03	.69618	1.695038	1.89138	3888.4	4872.4	159.281	86.09	115.97	.19646E-04	1596	1.99237
180.000	.1204E+02	.69986E+03	.66592	1.588411	1.77436	5037.8	6034.4	165.918	85.95	116.32	.54785E-04	1549	1.97697
190.000	.1189E+02	.69090E+03	.63905	1.489669	1.66355	6191.7	7201.2	172.224	86.13	116.99	.13503E-03	1503	1.96161
200.000	.1173E+02	.68194E+03	.61507	1.397878	1.55832	7353.2	8376.0	178.249	86.63	117.97	.29996E-03	1456	1.94628
210.000	.1158E+02	.67296E+03	.59360	1.312255	1.45818	8525.2	9561.6	184.034	87.41	119.24	.61012E-03	1410	1.93095
220.000	.1142E+02	.66394E+03	.57432	1.232135	1.36271	9710.4	10761.0	189.615	88.44	120.76	.11509E-02	1364	1.91562
230.000	.1127E+02	.65487E+03	.55696	1.156953	1.27160	10911.5	11976.6	195.021	89.70	122.52	.20346E-02	1317	1.90026
240.000	.1111E+02	.64574E+03	.54130	1.086223	1.18457	12130.7	13210.8	200.276	91.15	124.47	.34003E-02	1271	1.88486
250.000	.1095E+02	.63652E+03	.52717	1.019524	1.10142	13370.0	14465.8	205.400	92.76	126.60	.54114E-02	1226	1.86938
260.000	.1079E+02	.62722E+03	.51441	.956491	1.02198	14631.2	15743.3	210.409	94.49	128.88	.82504E-02	1180	1.85382
270.000	.1063E+02	.61780E+03	.50291	.896808	.94611	15915.7	17044.7	215.318	96.34	131.29	.12112E-01	1135	1.83815
280.000	.1046E+02	.60825E+03	.49256	.840196	.87369	17224.5	18371.2	220.138	98.28	133.82	.17194E-01	1090	1.82235
290.000	.1030E+02	.59856E+03	.48328	.786413	.80465	18558.5	19723.7	224.880	100.28	136.45	.23688E-01	1046	1.80638
300.000	.1013E+02	.58870E+03	.47499	.735247	.73889	19918.3	21103.1	229.551	102.35	139.16	.31771E-01	1002	1.79023
310.000	.9955E+01	.57865E+03	.46765	.686512	.67638	21304.5	22509.8	234.159	104.46	141.95	.41593E-01	958	1.77387
320.000	.9779E+01	.56839E+03	.46122	.640045	.61704	22717.3	23944.5	238.711	106.59	144.81	.53273E-01	915	1.75725
330.000	.9598E+01	.55790E+03	.45565	.595706	.56086	24157.2	25407.4	243.212	108.72	147.71	.66894E-01	872	1.74037
340.000	.9413E+01	.54714E+03	.45095	.553373	.50778	25624.1	26898.9	247.665	110.82	150.63	.82502E-01	830	1.72317
350.000	.9223E+01	.53609E+03	.44709	.512943	.45778	27118.1	28419.1	252.073	112.84	153.53	.10011E+00	789	1.70563
360.000	.9028E+01	.52472E+03	.44409	.474331	.41084	28638.7	29968.0	256.438	114.73	156.34	.11969E+00	748	1.68769
370.000	.8826E+01	.51299E+03	.44197	.437465	.36691	30184.9	31544.5	260.758	116.38	159.00	.14121E+00	708	1.66933
380.000	.8617E+01	.50086E+03	.44076	.402293	.32599	31754.4	33147.0	265.031	117.66	161.37	.16458E+00	668	1.65049
390.000	.8401E+01	.48829E+03	.44051	.368774	.28804	33342.9	34771.3	269.248	118.38	163.27	.18971E+00	630	1.63113
400.000	.8176E+01	.47524E+03	.44130	.336885	.25303	34942.4	36410.1	273.397	118.12	164.30	.21639E+00	593	1.61118
410.000	.7942E+01	.46165E+03	.44321	.306616	.22095	36537.5	38048.4	277.449	115.69	163.27	.24437E+00	558	1.59060
420.000	.7698E+01	.44747E+03	.44637	.277970	.19175	38092.0	39650.7	281.296	102.74	151.87	.27434E+00	532	1.56933
430.000	.7443E+01	.43264E+03	.45093	.250964	.16543	39954.1	41566.3	285.802	145.26	196.10	.30496E+00	472	1.54730
440.000	.7176E+01	.41711E+03	.45709	.225623	.14194	41845.1	43517.3	290.287	142.37	195.10	.33602E+00	441	1.52447
450.000	.6896E+01	.40083E+03	.46508	.201982	.12127	43737.0	45477.1	294.690	142.34	197.11	.36733E+00	409	1.50082
460.000	.6603E+01	.38380E+03	.47517	.180084	.10341	45645.3	47462.6	299.053	143.20	200.13	.39857E+00	380	0.00000
470.000	.6297E+01	.36603E+03	.48763	.159978	.08836	47575.3	49480.9	303.394	144.48	203.54	.42945E+00	352	0.00000
480.000	.5981E+01	.34764E+03	.50272	.141724	.07614	49526.9	51533.2	307.715	145.99	206.89	.45978E+00	328	0.00000
490.000	.5659E+01	.32891E+03	.52051	.125388	.06672	51496.1	53616.7	312.010	147.62	209.66	.48932E+00	307	0.00000
500.000	.5337E+01	.31021E+03	.54084	.111019	.05999	53474.3	55722.7	316.265	149.29	211.34	.51783E+00	291	0.00000
520.000	.4730E+01	.27492E+03	.58681	.088075	.05331	57415.3	59952.5	324.560	152.63	210.82	.57123E+00	271	0.00000
540.000	.4210E+01	.24471E+03	.63483	.071770	.05255	61285.2	64135.5	332.454	155.91	207.29	.61943E+00	264	0.00000
560.000	.3786E+01	.22008E+03	.68066	.060190	.05442	65076.5	68245.7	339.928	159.16	203.90	.66249E+00	264	0.00000
580.000	.3443E+01	.20011E+03	.72279	.051715	.05749	68813.3	72298.9	347.040	162.41	201.57	.70081E+00	267	0.00000
600.000	.3162E+01	.18381E+03	.76064	.045329	.06153	72519.8	76314.4	353.847	165.65	200.12	.73485E+00	272	0.00000
620.000	.2932E+01	.17039E+03	.79407	.040394	.06616	76215.9	80309.4	360.397	168.89	199.50	.76515E+00	279	0.00000
640.000	.2739E+01	.15920E+03	.82335	.036487	.07110	79917.9	84299.2	366.730	172.11	199.59	.79216E+00	287	0.00000
660.000	.2576E+01	.14972E+03	.84893	.033324	.07617	83638.2	88296.8	372.881	175.29	200.24	.81625E+00	294	0.00000
680.000	.2436E+01	.14159E+03	.87129	.030715	.08124	87385.7	92311.9	378.874	178.43	201.33	.83778E+00	302	0.00000
700.000	.2314E+01	.13452E+03	.89088	.028525	.08628	91166.9	96351.9	384.729	181.52	202.72	.85709E+00	310	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 13 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	Cv J/(mol•K)	Cp J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
137.022	.1271E+02	.73895E+03	.89755	2.121910	2.34387	81.2	1103.8	134.121	88.88	116.90	.19116E-06	1755	2.04425
140.000	.1267E+02	.73626E+03	.88167	2.078222	2.29978	425.5	1451.8	136.633	88.51	116.70	.32098E-06	1741	2.03961
150.000	.1251E+02	.72725E+03	.83309	1.940330	2.15858	1577.4	2616.4	144.665	87.42	116.17	.15445E-05	1693	2.02408
160.000	.1236E+02	.71828E+03	.79077	1.814476	2.02671	2725.2	3777.2	152.152	86.62	115.90	.59595E-05	1646	2.00862
170.000	.1220E+02	.70934E+03	.75364	1.698984	1.90288	3871.6	4936.8	159.178	86.14	115.93	.19218E-04	1600	1.99322
180.000	.1205E+02	.70042E+03	.72083	1.592491	1.78607	5019.5	6098.3	165.812	85.99	116.27	.53455E-04	1554	1.97788
190.000	.1190E+02	.69150E+03	.69170	1.493879	1.67549	6172.0	7264.7	172.115	86.18	116.94	.13146E-03	1507	1.96259
200.000	.1174E+02	.68258E+03	.66570	1.402216	1.57049	7331.9	8438.9	178.137	86.67	117.91	.29144E-03	1461	1.94732
210.000	.1159E+02	.67364E+03	.64242	1.316723	1.47058	8502.1	9623.8	183.919	87.45	119.16	.59174E-03	1415	1.93206
220.000	.1144E+02	.66467E+03	.62149	1.236735	1.37536	9685.5	10822.3	189.496	88.49	120.68	.11144E-02	1369	1.91681
230.000	.1128E+02	.65565E+03	.60265	1.161690	1.28449	10884.6	12037.0	194.898	89.75	122.42	.19672E-02	1323	1.90153
240.000	.1112E+02	.64658E+03	.58564	1.091102	1.19771	12101.6	13270.2	200.149	91.19	124.36	.32835E-02	1278	1.88622
250.000	.1097E+02	.63743E+03	.57029	1.024552	1.11481	13338.6	14524.0	205.268	92.80	126.47	.52193E-02	1232	1.87085
260.000	.1081E+02	.62819E+03	.55642	.961678	1.03563	14597.3	15800.1	210.272	94.54	128.73	.79490E-02	1187	1.85540
270.000	.1065E+02	.61885E+03	.54390	.902164	.96001	15878.9	17099.9	215.175	96.38	131.12	.11658E-01	1142	1.83985
280.000	.1048E+02	.60939E+03	.53261	.845732	.88785	17184.7	18424.6	219.988	98.32	133.62	.16535E-01	1098	1.82418
290.000	.1032E+02	.59979E+03	.52248	.792142	.81906	18515.3	19775.1	224.722	100.33	136.22	.22764E-01	1054	1.80836
300.000	.1015E+02	.59004E+03	.51341	.741184	.75356	19871.4	21152.1	229.385	102.39	138.90	.30510E-01	1011	1.79238
310.000	.9981E+01	.58011E+03	.50535	.692672	.69130	21253.5	22556.0	233.985	104.50	141.66	.39917E-01	968	1.77620
320.000	.9806E+01	.56999E+03	.49825	.646446	.63222	22661.8	23987.5	238.526	106.63	144.47	.51100E-01	925	1.75980
330.000	.9629E+01	.55966E+03	.49207	.602366	.57628	24096.5	25446.7	243.015	108.76	147.32	.64135E-01	883	1.74315
340.000	.9447E+01	.54908E+03	.48680	.560314	.52344	25557.7	26933.9	247.456	110.85	150.17	.79066E-01	842	1.72622
350.000	.9260E+01	.53824E+03	.48242	.520187	.47367	27045.3	28449.1	251.850	112.87	152.99	.95906E-01	801	1.70899
360.000	.9069E+01	.52711E+03	.47892	.481901	.42695	28558.6	29992.1	256.198	114.75	155.71	.11464E+00	761	1.69141
370.000	.8872E+01	.51566E+03	.47632	.445387	.38323	30096.5	31561.9	260.500	116.39	158.26	.13522E+00	721	1.67346
380.000	.8669E+01	.50385E+03	.47465	.410590	.34249	31656.6	33156.2	264.751	117.67	160.50	.15759E+00	683	1.65509
390.000	.8459E+01	.49167E+03	.47395	.377471	.30470	33234.2	34771.1	268.943	118.38	162.23	.18164E+00	646	1.63628
400.000	.8242E+01	.47906E+03	.47425	.346004	.26982	34821.2	36398.5	273.064	118.11	163.06	.20720E+00	610	1.61698
410.000	.8017E+01	.46601E+03	.47565	.316175	.23781	36401.8	38023.3	277.082	115.67	161.80	.23402E+00	576	1.59716
420.000	.7784E+01	.45246E+03	.47823	.287982	.20864	37939.4	39609.4	280.890	102.70	150.10	.26278E+00	552	1.57677
430.000	.7542E+01	.43839E+03	.48210	.261432	.18227	39781.8	41505.4	285.350	145.19	193.96	.29221E+00	493	1.55580
440.000	.7291E+01	.42377E+03	.48740	.236537	.15863	41649.8	43432.9	289.781	142.28	192.51	.32212E+00	463	1.53421
450.000	.7029E+01	.40856E+03	.49430	.213315	.13769	43515.0	45364.4	294.120	142.22	194.01	.35234E+00	433	1.51200
460.000	.6758E+01	.39279E+03	.50298	.191783	.11940	45392.3	47316.0	298.409	143.05	196.44	.38259E+00	404	0.00000
470.000	.6477E+01	.37646E+03	.51363	.171962	.10373	47287.2	49294.4	302.664	144.31	199.27	.41262E+00	378	0.00000
480.000	.6188E+01	.35967E+03	.52641	.153870	.09064	49200.6	51301.4	306.889	145.81	202.14	.44225E+00	354	0.00000
490.000	.5894E+01	.34257E+03	.54140	.137527	.08009	51130.6	53336.3	311.085	147.43	204.74	.47128E+00	333	0.00000
500.000	.5599E+01	.32542E+03	.55853	.122942	.07200	53072.3	55394.2	315.242	149.12	206.73	.49949E+00	315	0.00000
520.000	.5028E+01	.29227E+03	.59797	.098949	.06239	56963.0	59548.3	323.389	152.54	208.06	.55289E+00	291	0.00000
540.000	.4519E+01	.26264E+03	.64079	.081173	.05933	60819.7	63696.7	331.217	155.91	206.45	.60172E+00	280	0.00000
560.000	.4088E+01	.23761E+03	.68300	.068210	.05991	64621.1	67801.2	338.681	159.24	204.01	.64582E+00	277	0.00000
580.000	.3731E+01	.21686E+03	.72254	.058612	.06212	68377.3	71861.7	345.805	162.54	202.18	.68542E+00	277	0.00000
600.000	.3434E+01	.19961E+03	.75879	.051311	.06525	72108.3	75893.7	352.640	165.81	201.13	.72085E+00	281	0.00000
620.000	.3186E+01	.18520E+03	.79148	.045626	.06913	75830.9	79911.0	359.227	169.06	200.70	.75256E+00	286	0.00000
640.000	.2977E+01	.17304E+03	.82060	.041108	.07351	79558.9	83925.6	365.599	172.28	200.84	.78096E+00	292	0.00000
660.000	.2799E+01	.16269E+03	.84636	.037448	.07818	83303.3	87947.8	371.788	175.46	201.46	.80637E+00	299	0.00000
680.000	.2646E+01	.15378E+03	.86909	.034429	.08299	87072.8	91986.5	377.816	178.59	202.47	.82913E+00	306	0.00000
700.000	.2512E+01	.14601E+03	.88915	.031899	.08783	90873.6	96048.6	383.704	181.67	203.78	.84959E+00	313	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 14 MPa

Temp. K	Density mol/L	Density kg/m³	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m³/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
137.187	.1272E+02	.73923E+03	.96507	2.122892	2.35225	87.7	1188.5	134.165	88.91	116.86	.19584E-06	1758	2.04467
140.000	.1267E+02	.73669E+03	.94893	2.081703	2.31067	412.6	1517.2	136.536	88.56	116.68	.31896E-06	1744	2.04031
150.000	.1252E+02	.72771E+03	.89660	1.943976	2.16965	1563.3	2681.6	144.566	87.47	116.14	.15291E-05	1697	2.02482
160.000	.1237E+02	.71877E+03	.85102	1.818272	2.03798	2709.8	3842.0	152.052	86.66	115.87	.58808E-05	1650	2.00942
170.000	.1221E+02	.70986E+03	.81101	1.702918	1.91435	3854.9	5001.2	159.075	86.18	115.89	.18910E-04	1604	1.99407
180.000	.1206E+02	.70098E+03	.77567	1.596556	1.79776	5001.5	6162.3	165.707	86.04	116.23	.52466E-04	1558	1.97879
190.000	.1191E+02	.69210E+03	.74427	1.498071	1.68739	6152.4	7328.2	172.007	86.22	116.88	.12873E-03	1512	1.96355
200.000	.1175E+02	.68321E+03	.71625	1.406534	1.58262	7310.7	8501.8	178.026	86.71	117.85	.28484E-03	1466	1.94835
210.000	.1160E+02	.67432E+03	.69114	1.321166	1.48294	8479.3	9686.0	183.805	87.50	119.09	.57729E-03	1420	1.93317
220.000	.1145E+02	.66539E+03	.66857	1.241307	1.38795	9660.9	10883.8	189.379	88.53	120.59	.10855E-02	1375	1.91799
230.000	.1129E+02	.65643E+03	.64824	1.166394	1.29732	10858.0	12097.6	194.777	89.79	122.32	.19133E-02	1329	1.90279
240.000	.1114E+02	.64741E+03	.62989	1.095944	1.21079	12072.9	13329.8	200.023	91.24	124.25	.31894E-02	1284	1.88757
250.000	.1098E+02	.63832E+03	.61330	1.029539	1.12814	13307.6	14582.4	205.137	92.84	126.35	.50637E-02	1239	1.87229
260.000	.1082E+02	.62915E+03	.59830	.966817	1.04919	14563.8	15857.2	210.136	94.58	128.59	.77038E-02	1194	1.85695
270.000	.1066E+02	.61988E+03	.58476	.907464	.97382	15842.8	17155.5	215.033	96.42	130.96	.11288E-01	1150	1.84152
280.000	.1050E+02	.61051E+03	.57253	.851204	.90191	17145.6	18478.4	219.840	98.36	133.44	.15996E-01	1106	1.82598
290.000	.1034E+02	.60100E+03	.56153	.797798	.83337	18473.0	19826.9	224.567	100.37	136.01	.22004E-01	1062	1.81030
300.000	.1017E+02	.59136E+03	.55167	.747036	.76811	19825.5	21201.6	229.222	102.43	138.66	.29470E-01	1019	1.79448
310.000	.1001E+02	.58155E+03	.54288	.698735	.70609	21203.7	22602.9	233.813	104.54	141.38	.38534E-01	977	1.77848
320.000	.9833E+01	.57156E+03	.53511	.652734	.64725	22607.6	24031.3	238.345	106.66	144.14	.49301E-01	935	1.76228
330.000	.9658E+01	.56137E+03	.52831	.608897	.59153	24037.5	25487.0	242.824	108.79	146.94	.61847E-01	893	1.74586
340.000	.9479E+01	.55096E+03	.52245	.567105	.53892	25493.3	26970.2	247.252	110.89	149.74	.76215E-01	853	1.72919
350.000	.9296E+01	.54032E+03	.51753	.527256	.48936	26974.8	28480.8	251.632	112.90	152.49	.92416E-01	812	1.71224
360.000	.9108E+01	.52941E+03	.51352	.489267	.44284	28481.4	30018.4	255.965	114.78	155.13	.11043E+00	773	1.69499
370.000	.8916E+01	.51821E+03	.51044	.453068	.39930	30011.6	31581.9	260.250	116.41	157.58	.13024E+00	735	1.67742
380.000	.8718E+01	.50671E+03	.50829	.418606	.35872	31563.0	33168.9	264.481	117.69	159.71	.15176E+00	697	1.65948
390.000	.8514E+01	.49486E+03	.50711	.385838	.32106	33130.9	34775.2	268.652	118.39	161.31	.17491E+00	661	1.64117
400.000	.8304E+01	.48266E+03	.50693	.354737	.28628	34706.7	36392.7	272.747	118.11	161.98	.19952E+00	626	1.62244
410.000	.8087E+01	.47007E+03	.50781	.325285	.25433	36274.6	38005.6	276.736	115.65	160.52	.22536E+00	594	1.60328
420.000	.7864E+01	.45707E+03	.50982	.297472	.22516	37797.6	39577.9	280.511	102.67	148.59	.25311E+00	570	1.58366
430.000	.7633E+01	.44364E+03	.51303	.271297	.19872	39623.3	41457.5	284.932	145.14	192.18	.28153E+00	512	1.56358
440.000	.7394E+01	.42977E+03	.51757	.246762	.17494	41472.1	43365.6	289.318	142.21	190.41	.31045E+00	483	1.54301
450.000	.7147E+01	.41543E+03	.52352	.223871	.15376	43315.4	45274.2	293.606	142.13	191.53	.33974E+00	455	1.52198
460.000	.6893E+01	.40065E+03	.53104	.202625	.13511	45168.0	47199.0	297.836	142.94	193.56	.36914E+00	427	0.00000
470.000	.6632E+01	.38545E+03	.54023	.183024	.11893	47035.4	49146.5	302.025	144.18	195.97	.39840E+00	402	0.00000
480.000	.6364E+01	.36990E+03	.55122	.165064	.10516	48918.9	51118.8	306.177	145.66	198.50	.42738E+00	378	0.00000
490.000	.6092E+01	.35411E+03	.56405	.148735	.09373	50817.9	53115.9	310.295	147.28	200.89	.45591E+00	357	0.00000
500.000	.5819E+01	.33823E+03	.57872	.134025	.08458	52729.5	55135.4	314.374	148.97	202.93	.48376E+00	339	0.00000
520.000	.5284E+01	.30714E+03	.61279	.109323	.07250	56572.2	59221.6	322.388	152.44	205.25	.53694E+00	312	0.00000
540.000	.4791E+01	.27849E+03	.65079	.090402	.06715	60407.0	63328.9	330.138	155.89	205.14	.58612E+00	297	0.00000
560.000	.4361E+01	.25350E+03	.68942	.076221	.06615	64208.8	67418.8	337.575	159.28	203.76	.63097E+00	290	0.00000
580.000	.3997E+01	.23231E+03	.72637	.065560	.06748	67977.0	71479.8	344.701	162.62	202.41	.67156E+00	289	0.00000
600.000	.3689E+01	.21443E+03	.76069	.057389	.06989	71724.7	75519.5	351.549	165.93	201.67	.70813E+00	291	0.00000
620.000	.3429E+01	.19928E+03	.79212	.050982	.07303	75467.0	79550.3	358.157	169.20	201.49	.74104E+00	294	0.00000
640.000	.3206E+01	.18636E+03	.82056	.045862	.07679	79215.8	83582.2	364.557	172.43	201.76	.77064E+00	299	0.00000
660.000	.3015E+01	.17527E+03	.84606	.041701	.08097	82980.7	87623.5	370.775	175.61	202.43	.79723E+00	305	0.00000
680.000	.2850E+01	.16566E+03	.86880	.038264	.08541	86769.4	91681.5	376.832	178.74	203.43	.82113E+00	311	0.00000
700.000	.2706E+01	.15727E+03	.88902	.035384	.08999	90588.1	95762.3	382.747	181.81	204.70	.84264E+00	318	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 16 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
137.515	.1273E+02	.73978E+03	1.09948	2.124883	2.36901	100.7	1357.8	134.254	88.96	116.79	.20838E-06	1763	2.04552
140.000	.1269E+02	.73755E+03	1.08323	2.088648	2.33241	387.1	1648.0	136.344	88.65	116.63	.31958E-06	1751	2.04168
150.000	.1254E+02	.72863E+03	1.02340	1.951246	2.19175	1535.5	2811.8	144.370	87.56	116.09	.15206E-05	1704	2.02630
160.000	.1238E+02	.71975E+03	.97128	1.825834	2.06045	2679.5	3971.6	151.852	86.75	115.80	.58104E-05	1658	2.01099
170.000	.1223E+02	.71090E+03	.92552	1.710749	1.93722	3822.0	5130.2	158.871	86.27	115.81	.18577E-04	1612	1.99575
180.000	.1208E+02	.70208E+03	.88508	1.604642	1.82103	4965.8	6290.4	165.498	86.12	116.14	.51283E-04	1567	1.98058
190.000	.1193E+02	.69327E+03	.84915	1.506402	1.71109	6113.8	7455.3	171.793	86.31	116.78	.12527E-03	1521	1.96546
200.000	.1178E+02	.68447E+03	.81707	1.415108	1.60676	7269.1	8627.8	177.806	86.80	117.73	.27606E-03	1476	1.95039
210.000	.1162E+02	.67566E+03	.78831	1.329982	1.50753	8434.3	9810.8	183.578	87.58	118.95	.55749E-03	1430	1.93534
220.000	.1147E+02	.66682E+03	.76245	1.250370	1.41299	9612.4	11007.0	189.145	88.62	120.44	.10448E-02	1385	1.92031
230.000	.1132E+02	.65795E+03	.73913	1.175709	1.32282	10805.7	12219.2	194.536	89.87	122.14	.18364E-02	1340	1.90527
240.000	.1117E+02	.64904E+03	.71806	1.105520	1.23676	12016.6	13449.4	199.774	91.32	124.04	.30531E-02	1296	1.89022
250.000	.1101E+02	.64007E+03	.69899	1.039389	1.15457	13246.9	14699.8	204.879	92.92	126.11	.48359E-02	1251	1.87513
260.000	.1086E+02	.63103E+03	.68174	.976955	1.07610	14498.3	15972.1	209.868	94.66	128.32	.73413E-02	1207	1.85999
270.000	.1070E+02	.62191E+03	.66612	.917905	1.00120	15772.1	17267.5	214.754	96.51	130.65	.10736E-01	1164	1.84479
280.000	.1054E+02	.61269E+03	.65199	.861966	.92976	17069.2	18587.1	219.549	98.44	133.09	.15187E-01	1121	1.82949
290.000	.1038E+02	.60336E+03	.63924	.808902	.86167	18390.5	19931.8	224.263	100.45	135.61	.20858E-01	1078	1.81410
300.000	.1022E+02	.59391E+03	.62777	.758502	.79688	19736.3	21302.2	228.904	102.51	138.20	.27896E-01	1036	1.79857
310.000	.1005E+02	.58432E+03	.61749	.710587	.73530	21107.1	22698.7	233.479	104.61	140.85	.36429E-01	994	1.78291
320.000	.9885E+01	.57458E+03	.60833	.664998	.67689	22502.9	24121.4	237.993	106.74	143.55	.46556E-01	954	1.76709
330.000	.9715E+01	.56467E+03	.60025	.621599	.62159	23923.8	25570.8	242.452	108.86	146.26	.58346E-01	913	1.75108
340.000	.9541E+01	.55457E+03	.59320	.580271	.56937	25369.7	27046.6	246.858	110.95	148.95	.71838E-01	874	1.73488
350.000	.9364E+01	.54428E+03	.58715	.540914	.52019	26840.1	28548.8	251.214	112.96	151.59	.87045E-01	835	1.71846
360.000	.9183E+01	.53377E+03	.58208	.503445	.47400	28334.4	30076.7	255.520	114.83	154.10	.10395E+00	797	1.70180
370.000	.8999E+01	.52303E+03	.57798	.467792	.43077	29851.0	31629.1	259.774	116.46	156.39	.12254E+00	760	1.68490
380.000	.8810E+01	.51205E+03	.57484	.433899	.39045	31387.1	33203.4	263.971	117.72	158.34	.14274E+00	724	1.66772
390.000	.8616E+01	.50080E+03	.57268	.401720	.35299	32937.9	34794.9	268.104	118.41	159.73	.16447E+00	690	1.65027
400.000	.8418E+01	.48928E+03	.57151	.371222	.31835	34494.6	36395.3	272.156	118.11	160.15	.18760E+00	657	1.63252
410.000	.8215E+01	.47748E+03	.57135	.342376	.28646	36041.0	37988.7	276.096	115.63	158.41	.21191E+00	626	1.61447
420.000	.8007E+01	.46538E+03	.57225	.315163	.25725	37539.8	39538.2	279.816	102.63	146.15	.23804E+00	605	1.59611
430.000	.7793E+01	.45297E+03	.57425	.289568	.23066	39338.5	41391.5	284.176	145.08	189.36	.26486E+00	548	1.57745
440.000	.7575E+01	.44027E+03	.57739	.265576	.20661	41157.0	43269.3	288.492	142.12	187.16	.29223E+00	521	1.55850
450.000	.7351E+01	.42727E+03	.58174	.243172	.18500	42966.5	45143.1	292.702	142.01	187.80	.32002E+00	494	1.53928
460.000	.7122E+01	.41399E+03	.58735	.222336	.16575	44781.7	47028.1	296.844	142.79	189.32	.34801E+00	468	0.00000
470.000	.6890E+01	.40045E+03	.59428	.203045	.14876	46608.2	48930.6	300.936	144.00	191.21	.37600E+00	444	0.00000
480.000	.6653E+01	.38671E+03	.60259	.185270	.13396	48447.9	50852.8	304.983	145.46	193.27	.40387E+00	421	0.00000
490.000	.6414E+01	.37282E+03	.61228	.168975	.12124	50301.3	52795.8	308.989	147.07	195.32	.43148E+00	401	0.00000
500.000	.6174E+01	.35887E+03	.62336	.154121	.11053	52167.4	54758.8	312.955	148.76	197.26	.45862E+00	382	0.00000
520.000	.5699E+01	.33125E+03	.64935	.128541	.09469	55929.4	58736.9	320.756	152.26	200.33	.51106E+00	352	0.00000
540.000	.5246E+01	.30493E+03	.67927	.108049	.08534	59712.5	62762.3	328.352	155.79	201.97	.56041E+00	332	0.00000
560.000	.4832E+01	.28087E+03	.71112	.091960	.08097	63496.3	66807.3	335.707	159.28	202.37	.60613E+00	320	0.00000
580.000	.4466E+01	.25958E+03	.74291	.079435	.07994	67270.9	70853.5	342.806	162.71	202.20	.64810E+00	315	0.00000
600.000	.4147E+01	.24106E+03	.77332	.069639	.08089	71037.9	74895.7	349.658	166.08	202.06	.68636E+00	313	0.00000
620.000	.3871E+01	.22503E+03	.80171	.061872	.08293	74805.3	78938.1	356.286	169.39	202.24	.72114E+00	314	0.00000
640.000	.3632E+01	.21109E+03	.82792	.055605	.08555	78582.5	82988.1	362.714	172.64	202.81	.75270E+00	317	0.00000
660.000	.3422E+01	.19892E+03	.85194	.050470	.08868	82377.6	87052.6	368.968	175.84	203.68	.78126E+00	320	0.00000
680.000	.3239E+01	.18824E+03	.87380	.046204	.09223	86196.7	91137.0	375.065	178.97	204.79	.80708E+00	324	0.00000
700.000	.3076E+01	.17882E+03	.89359	.042617	.09610	90044.7	95245.6	381.019	182.04	206.09	.83045E+00	329	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 18 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
137.843	.1274E+02	.74033E+03	1.23306	2.126908	2.38576	113.8	1527.0	134.341	89.01	116.73	.22499E-06	1768	2.04636
140.000	.1270E+02	.73841E+03	1.21722	2.095574	2.35410	361.9	1778.8	136.153	88.74	116.58	.32524E-06	1758	2.04305
150.000	.1255E+02	.72954E+03	1.14989	1.958487	2.21378	1508.0	2942.2	144.176	87.65	116.03	.15360E-05	1711	2.02776
160.000	.1240E+02	.72071E+03	1.09122	1.833357	2.08284	2649.7	4101.4	151.654	86.84	115.74	.58310E-05	1666	2.01255
170.000	.1225E+02	.71193E+03	1.03970	1.718531	1.95999	3789.6	5259.2	158.669	86.36	115.74	.18536E-04	1620	1.99741
180.000	.1210E+02	.70317E+03	.99417	1.612669	1.84420	4930.8	6418.7	165.291	86.21	116.05	.50913E-04	1575	1.98235
190.000	.1195E+02	.69443E+03	.95369	1.514665	1.73466	6076.0	7582.6	171.581	86.39	116.68	.12381E-03	1530	1.96735
200.000	.1180E+02	.68570E+03	.91754	1.423601	1.63075	7228.2	8754.0	177.589	86.89	117.61	.27175E-03	1485	1.95239
210.000	.1165E+02	.67697E+03	.88512	1.338706	1.53195	8390.3	9935.8	183.355	87.67	118.82	.54681E-03	1440	1.93748
220.000	.1150E+02	.66822E+03	.85595	1.259326	1.43784	9565.0	11130.7	188.916	88.70	120.29	.10215E-02	1396	1.92259
230.000	.1135E+02	.65945E+03	.82963	1.184903	1.34811	10754.7	12341.2	194.299	89.96	121.97	.17902E-02	1352	1.90770
240.000	.1119E+02	.65064E+03	.80583	1.114959	1.26249	11961.6	13569.6	199.529	91.40	123.85	.29684E-02	1307	1.89282
250.000	.1104E+02	.64178E+03	.78427	1.049082	1.18075	13187.7	14817.9	204.626	93.01	125.89	.46905E-02	1264	1.87791
260.000	.1089E+02	.63287E+03	.76473	.986914	1.10272	14434.6	16087.8	209.605	94.74	128.07	.71052E-02	1220	1.86296
270.000	.1073E+02	.62388E+03	.74701	.928144	1.02826	15703.5	17380.5	214.482	96.59	130.37	.10370E-01	1178	1.84797
280.000	.1058E+02	.61481E+03	.73096	.872499	.95725	16995.4	18697.1	219.266	98.52	132.76	.14644E-01	1135	1.83291
290.000	.1042E+02	.60565E+03	.71643	.819744	.88960	18310.9	20038.3	223.967	100.52	135.24	.20080E-01	1093	1.81777
300.000	.1026E+02	.59638E+03	.70332	.769672	.82521	19650.5	21404.8	228.595	102.59	137.78	.26817E-01	1052	1.80253
310.000	.1010E+02	.58699E+03	.69152	.722102	.76404	21014.4	22796.7	233.155	104.69	140.38	.34974E-01	1012	1.78717
320.000	.9935E+01	.57747E+03	.68095	.676878	.70602	22402.7	24214.5	237.653	106.81	143.00	.44644E-01	972	1.77169
330.000	.9769E+01	.56781E+03	.67155	.633862	.65109	23815.4	25658.0	242.094	108.93	145.64	.55892E-01	933	1.75606
340.000	.9600E+01	.55800E+03	.66326	.592937	.59921	25252.3	27127.3	246.481	111.02	148.26	.68756E-01	894	1.74028
350.000	.9428E+01	.54802E+03	.65604	.554002	.55035	26713.0	28622.1	250.815	113.02	150.80	.83245E-01	856	1.72433
360.000	.9254E+01	.53786E+03	.64986	.516971	.50444	28196.4	30141.6	255.097	114.88	153.20	.99350E-01	820	1.70819
370.000	.9076E+01	.52752E+03	.64470	.481772	.46145	29701.1	31684.5	259.325	116.50	155.38	.11704E+00	784	1.69187
380.000	.8894E+01	.51698E+03	.64053	.448345	.42132	31224.1	33247.9	263.494	117.76	157.19	.13628E+00	749	1.67534
390.000	.8709E+01	.50623E+03	.63735	.416639	.38401	32760.4	34827.2	267.595	118.43	158.42	.15699E+00	716	1.65861
400.000	.8521E+01	.49527E+03	.63517	.386613	.34944	34301.2	36413.6	271.611	118.12	158.67	.17902E+00	685	1.64167
410.000	.8329E+01	.48410E+03	.63398	.358234	.31756	35830.0	37991.2	275.512	115.63	156.73	.20221E+00	656	1.62452
420.000	.8133E+01	.47271E+03	.63379	.331472	.28828	37309.6	39522.8	279.189	102.61	144.25	.22715E+00	636	1.60716
430.000	.7933E+01	.46111E+03	.63463	.306301	.26153	39087.0	41355.9	283.501	145.04	187.21	.25279E+00	581	1.58961
440.000	.7730E+01	.44929E+03	.63652	.282694	.23721	40882.3	43211.0	287.766	142.07	184.75	.27899E+00	555	1.57189
450.000	.7523E+01	.43728E+03	.63948	.260624	.21523	42666.6	45059.2	291.918	141.93	185.10	.30565E+00	529	1.55401
460.000	.7313E+01	.42508E+03	.64352	.240061	.19548	44454.4	46915.7	295.997	142.69	186.32	.33258E+00	505	0.00000
470.000	.7101E+01	.41273E+03	.64869	.220967	.17786	46251.8	48786.7	300.022	143.89	187.91	.35958E+00	481	0.00000
480.000	.6886E+01	.40025E+03	.65498	.203303	.16228	48060.5	50674.5	303.996	145.33	189.69	.38657E+00	460	0.00000
490.000	.6670E+01	.38769E+03	.66240	.187022	.14863	49881.9	52580.6	307.926	146.93	191.52	.41341E+00	440	0.00000
500.000	.6453E+01	.37510E+03	.67093	.172073	.13681	51715.6	54504.8	311.814	148.62	193.32	.43993E+00	421	0.00000
520.000	.6024E+01	.35013E+03	.69114	.145951	.11828	55416.3	58404.5	319.461	152.13	196.54	.49156E+00	390	0.00000
540.000	.5608E+01	.32597E+03	.71486	.124456	.10583	59151.1	62360.7	326.926	155.70	198.94	.54073E+00	367	0.00000
560.000	.5218E+01	.30329E+03	.74088	.107031	.09840	62906.4	66356.0	334.191	159.25	200.45	.58683E+00	351	0.00000
580.000	.4862E+01	.28258E+03	.76776	.093045	.09478	66671.8	70374.3	341.241	162.74	201.30	.62964E+00	342	0.00000
600.000	.4543E+01	.26404E+03	.79427	.081842	.09380	70443.8	74406.2	348.076	166.16	201.87	.66904E+00	337	0.00000
620.000	.4260E+01	.24763E+03	.81959	.072819	.09452	74224.5	78449.5	354.704	169.51	202.48	.70518E+00	336	0.00000
640.000	.4011E+01	.23315E+03	.84330	.065474	.09626	78019.1	82506.5	361.144	172.79	203.27	.73821E+00	336	0.00000
660.000	.3791E+01	.22034E+03	.86529	.059418	.09857	81833.5	86581.9	367.414	176.00	204.30	.76830E+00	338	0.00000
680.000	.3595E+01	.20896E+03	.88556	.054358	.10129	85673.3	90680.2	373.532	179.15	205.56	.79568E+00	340	0.00000
700.000	.3420E+01	.19881E+03	.90418	.050082	.10438	89542.7	94805.2	379.510	182.23	206.96	.82057E+00	344	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 20 MPa

Temp. K	Density mol/L	Density kg/m^3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m^3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
138.169	.1275E+02	.74088E+03	1.36583	2.128966	2.40251	127.1	1696.1	134.429	89.06	116.66	.24567E-06	1774	2.04719
140.000	.1272E+02	.73925E+03	1.35092	2.102479	2.37573	337.2	1909.7	135.964	88.83	116.54	.33508E-06	1765	2.04440
150.000	.1257E+02	.73043E+03	1.27608	1.965697	2.23574	1481.0	3072.5	143.984	87.74	115.98	.15707E-05	1719	2.02920
160.000	.1242E+02	.72167E+03	1.21086	1.840841	2.10515	2620.3	4231.2	151.458	86.93	115.67	.59239E-05	1673	2.01408
170.000	.1227E+02	.71294E+03	1.15358	1.726266	1.98266	3757.8	5388.4	158.469	86.44	115.66	.18724E-04	1628	1.99905
180.000	.1212E+02	.70425E+03	1.10294	1.620639	1.86724	4896.4	6547.0	165.087	86.30	115.97	.51169E-04	1584	1.98409
190.000	.1197E+02	.69558E+03	1.05792	1.522861	1.75810	6038.9	7710.1	171.372	86.48	116.58	.12387E-03	1539	1.96920
200.000	.1182E+02	.68692E+03	1.01769	1.432017	1.65459	7188.2	8880.5	177.374	86.97	117.50	.27080E-03	1495	1.95437
210.000	.1167E+02	.67827E+03	.98159	1.347340	1.55620	8347.2	10061.1	183.135	87.75	118.70	.54294E-03	1450	1.93958
220.000	.1152E+02	.66960E+03	.94910	1.268179	1.46251	9518.6	11254.6	188.689	88.78	120.14	.10110E-02	1406	1.92482
230.000	.1137E+02	.66092E+03	.91976	1.193980	1.37320	10704.8	12463.6	194.066	90.04	121.81	.17666E-02	1362	1.91009
240.000	.1122E+02	.65221E+03	.89321	1.124267	1.28799	11908.0	13690.3	199.289	91.48	123.67	.29215E-02	1319	1.89536
250.000	.1107E+02	.64346E+03	.86914	1.058627	1.20667	13130.1	14936.7	204.377	93.09	125.68	.46053E-02	1276	1.88062
260.000	.1092E+02	.63466E+03	.84730	.996706	1.12907	14372.7	16204.3	209.348	94.82	127.83	.69610E-02	1233	1.86586
270.000	.1077E+02	.62580E+03	.82747	.938193	1.05502	15636.9	17494.5	214.215	96.67	130.10	.10139E-01	1191	1.85107
280.000	.1061E+02	.61687E+03	.80947	.882818	.98441	16923.8	18808.3	218.989	98.60	132.46	.14293E-01	1149	1.83623
290.000	.1046E+02	.60786E+03	.79314	.830345	.91716	18233.9	20146.3	223.679	100.60	134.89	.19566E-01	1108	1.82132
300.000	.1030E+02	.59876E+03	.77835	.780569	.85316	19567.6	21509.1	228.294	102.66	137.39	.26093E-01	1068	1.80634
310.000	.1014E+02	.58956E+03	.76500	.733309	.79235	20925.2	22897.0	232.841	104.76	139.94	.33984E-01	1028	1.79128
320.000	.9983E+01	.58025E+03	.75299	.688408	.73467	22306.6	24310.1	237.324	106.88	142.52	.43330E-01	989	1.77611
330.000	.9821E+01	.57082E+03	.74223	.645731	.68008	23711.9	25748.4	241.749	109.00	145.09	.54189E-01	951	1.76083
340.000	.9656E+01	.56126E+03	.73268	.605158	.62850	25140.7	27211.9	246.118	111.08	147.64	.66598E-01	913	1.74543
350.000	.9489E+01	.55156E+03	.72426	.566587	.57990	26592.4	28700.1	250.434	113.08	150.10	.80566E-01	877	1.72989
360.000	.9320E+01	.54171E+03	.71694	.529930	.53423	28066.3	30212.2	254.695	114.94	152.42	.96085E-01	841	1.71422
370.000	.9148E+01	.53172E+03	.71067	.495113	.49143	29560.4	31746.7	258.900	116.55	154.50	.11313E+00	807	1.69841
380.000	.8973E+01	.52156E+03	.70545	.462072	.45146	31072.0	33300.8	263.044	117.80	156.20	.13166E+00	773	1.68244
390.000	.8796E+01	.51124E+03	.70123	.430752	.41424	32595.8	34869.6	267.118	118.47	157.32	.15160E+00	741	1.66633
400.000	.8615E+01	.50076E+03	.69801	.401106	.37971	34123.0	36444.5	271.105	118.15	157.43	.17283E+00	711	1.65007
410.000	.8432E+01	.49012E+03	.69577	.373094	.34780	35637.1	38008.9	274.974	115.65	155.35	.19518E+00	683	1.63367
420.000	.8246E+01	.47931E+03	.69452	.346680	.31843	37100.7	39526.1	278.616	102.61	142.72	.21925E+00	665	1.61713
430.000	.8058E+01	.46835E+03	.69425	.321828	.29151	38860.9	41343.1	282.890	145.03	185.51	.24400E+00	610	1.60048
440.000	.7866E+01	.45723E+03	.69496	.298505	.26694	40637.8	43180.2	287.113	142.04	182.87	.26932E+00	586	1.58373
450.000	.7673E+01	.44599E+03	.69666	.276674	.24462	42402.2	45008.8	291.221	141.89	183.04	.29513E+00	561	1.56690
460.000	.7477E+01	.43462E+03	.69934	.256297	.22444	44169.0	46843.7	295.253	142.64	184.06	.32125E+00	538	0.00000
470.000	.7280E+01	.42315E+03	.70300	.237331	.20629	45944.0	48691.2	299.227	143.82	185.47	.34749E+00	515	0.00000
480.000	.7082E+01	.41162E+03	.70764	.219729	.19008	47729.6	50553.8	303.148	145.25	187.08	.37379E+00	494	0.00000
490.000	.6883E+01	.40005E+03	.71326	.203440	.17569	49527.1	52432.9	307.023	146.84	188.76	.40001E+00	475	0.00000
500.000	.6684E+01	.38847E+03	.71981	.188408	.16302	51336.5	54328.9	310.853	148.52	190.45	.42601E+00	457	0.00000
520.000	.6289E+01	.36552E+03	.73560	.161887	.14245	54990.3	58170.7	318.387	152.04	193.66	.47691E+00	425	0.00000
540.000	.5904E+01	.34317E+03	.75449	.139683	.12760	58684.5	62072.0	325.748	155.63	196.38	.52579E+00	401	0.00000
560.000	.5538E+01	.32188E+03	.77566	.121290	.11763	62410.4	66022.0	332.931	159.21	198.50	.57204E+00	382	0.00000
580.000	.5196E+01	.30203E+03	.79813	.106181	.11161	66159.6	70008.5	339.925	162.74	200.07	.61537E+00	370	0.00000
600.000	.4884E+01	.28387E+03	.82088	.093818	.10858	69927.4	74022.5	346.729	166.20	201.28	.65559E+00	362	0.00000
620.000	.4602E+01	.26747E+03	.84312	.083691	.10770	73712.5	78058.8	353.346	169.58	202.34	.69273E+00	358	0.00000
640.000	.4348E+01	.25275E+03	.86433	.075349	.10826	77517.0	82116.4	359.787	172.89	203.43	.72690E+00	356	0.00000
660.000	.4122E+01	.23957E+03	.88424	.068417	.10977	81344.4	86196.7	366.065	176.13	204.63	.75821E+00	357	0.00000
680.000	.3918E+01	.22776E+03	.90275	.062597	.11187	85198.5	90302.6	372.193	179.29	205.98	.78683E+00	358	0.00000
700.000	.3736E+01	.21713E+03	.91988	.057660	.11432	89083.0	94436.9	378.185	182.38	207.47	.81299E+00	360	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 22 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	Cv J/(mol•K)	Cp J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
138.495	.1276E+02	.74142E+03	1.49778	2.131055	2.41925	140.4	1865.1	134.517	89.10	116.59	.27064E-06	1779	2.04802
140.000	.1273E+02	.74009E+03	1.48433	2.109362	2.39731	312.8	2040.6	135.777	88.92	116.49	.34865E-06	1772	2.04574
150.000	.1258E+02	.73132E+03	1.40198	1.972879	2.25763	1454.5	3203.0	143.793	87.82	115.93	.16221E-05	1726	2.03063
160.000	.1243E+02	.72261E+03	1.33021	1.848287	2.12737	2591.5	4361.1	151.264	87.01	115.61	.60781E-05	1681	2.01561
170.000	.1228E+02	.71394E+03	1.26716	1.733955	2.00523	3726.5	5517.6	158.271	86.53	115.60	.19102E-04	1636	2.00067
180.000	.1213E+02	.70531E+03	1.21140	1.628554	1.89018	4862.6	6675.6	164.885	86.38	115.89	.51937E-04	1592	1.98582
190.000	.1199E+02	.69671E+03	1.16182	1.530991	1.78141	6002.4	7837.8	171.165	86.56	116.49	.12517E-03	1548	1.97103
200.000	.1184E+02	.68812E+03	1.11750	1.440357	1.67829	7148.9	9007.2	177.162	87.05	117.40	.27253E-03	1504	1.95632
210.000	.1169E+02	.67954E+03	1.07773	1.355888	1.58029	8304.9	10186.7	182.918	87.83	118.58	.54444E-03	1460	1.94165
220.000	.1154E+02	.67096E+03	1.04190	1.276935	1.48700	9473.1	11379.0	188.466	88.86	120.01	.10105E-02	1417	1.92703
230.000	.1140E+02	.66236E+03	1.00953	1.202947	1.39809	10655.9	12586.5	193.836	90.12	121.66	.17605E-02	1373	1.91243
240.000	.1125E+02	.65375E+03	.98022	1.133448	1.31328	11855.6	13811.6	199.052	91.56	123.49	.29037E-02	1330	1.89785
250.000	.1110E+02	.64510E+03	.95362	1.068030	1.23236	13073.9	15056.1	204.133	93.16	125.48	.45663E-02	1288	1.88328
260.000	.1095E+02	.63641E+03	.92947	1.006338	1.15515	14312.3	16321.6	209.096	94.90	127.61	.68869E-02	1246	1.86870
270.000	.1080E+02	.62767E+03	.90750	.948062	1.08149	15572.2	17609.5	213.953	96.74	129.85	.10012E-01	1204	1.85409
280.000	.1065E+02	.61888E+03	.88753	.892935	1.01127	16854.3	18920.6	218.718	98.67	132.18	.14087E-01	1163	1.83946
290.000	.1049E+02	.61001E+03	.86938	.840720	.94437	18159.3	20255.6	223.397	100.67	134.58	.19253E-01	1123	1.82478
300.000	.1034E+02	.60107E+03	.85290	.791212	.88073	19487.6	21615.0	228.001	102.73	137.04	.25637E-01	1083	1.81004
310.000	.1019E+02	.59204E+03	.83798	.744231	.82026	20839.3	22999.1	232.535	104.83	139.54	.33346E-01	1044	1.79524
320.000	.1003E+02	.58292E+03	.82449	.699620	.76290	22214.3	24408.0	237.006	106.95	142.07	.42464E-01	1006	1.78036
330.000	.9870E+01	.57370E+03	.81236	.657243	.70859	23612.7	25841.6	241.416	109.07	144.59	.53049E-01	969	1.76540
340.000	.9710E+01	.56437E+03	.80150	.616978	.65728	25034.0	27299.8	245.770	111.15	147.08	.65133E-01	932	1.75034
350.000	.9547E+01	.55492E+03	.79185	.578724	.60892	26477.8	28782.1	250.068	113.14	149.48	.78726E-01	896	1.73519
360.000	.9383E+01	.54536E+03	.78336	.542389	.56345	27942.9	30287.7	254.311	114.99	151.73	.93820E-01	862	1.71993
370.000	.9216E+01	.53567E+03	.77597	.507897	.52081	29427.7	31814.9	258.496	116.60	153.73	.11039E+00	828	1.70457
380.000	.9047E+01	.52585E+03	.76966	.475180	.48094	30929.1	33360.9	262.618	117.84	155.34	.12840E+00	796	1.68910
390.000	.8876E+01	.51591E+03	.76438	.444179	.44379	32442.1	34920.7	266.668	118.50	156.37	.14778E+00	765	1.67353
400.000	.8703E+01	.50583E+03	.76011	.414843	.40927	33957.6	36485.5	270.630	118.18	156.39	.16842E+00	735	1.65785
410.000	.8527E+01	.49564E+03	.75683	.387126	.37732	35459.0	38039.0	274.472	115.67	154.20	.19015E+00	709	1.64209
420.000	.8350E+01	.48532E+03	.75452	.360985	.34784	36909.2	39544.1	278.085	102.62	141.45	.21356E+00	692	1.62624
430.000	.8170E+01	.47488E+03	.75316	.336380	.32074	38655.1	41347.8	282.328	145.03	184.13	.23765E+00	638	1.61033
440.000	.7989E+01	.46434E+03	.75275	.313270	.29592	40416.7	43170.5	286.518	142.03	181.36	.26232E+00	614	1.59437
450.000	.7806E+01	.45372E+03	.75327	.291613	.27329	42165.0	44983.3	290.590	141.87	181.41	.28749E+00	591	1.57839
460.000	.7622E+01	.44301E+03	.75470	.271366	.25273	43914.8	46801.3	294.585	142.61	182.30	.31299E+00	568	0.00000
470.000	.7437E+01	.43225E+03	.75703	.252481	.23412	45672.2	48630.6	298.520	143.78	183.59	.33865E+00	546	0.00000
480.000	.7251E+01	.42145E+03	.76025	.234909	.21737	47439.5	50473.6	302.400	145.20	185.08	.36442E+00	526	0.00000
490.000	.7065E+01	.41064E+03	.76434	.218595	.20237	49218.3	52332.3	306.232	146.78	186.66	.39016E+00	507	0.00000
500.000	.6879E+01	.39986E+03	.76926	.203483	.18901	51008.9	54206.9	310.019	148.46	188.28	.41575E+00	489	0.00000
520.000	.6512E+01	.37848E+03	.78145	.176632	.16682	54625.7	58004.3	317.466	151.97	191.43	.46605E+00	458	0.00000
540.000	.6152E+01	.35761E+03	.79642	.153879	.15007	58286.5	61862.3	324.746	155.58	194.30	.51464E+00	432	0.00000
560.000	.5808E+01	.33757E+03	.81357	.134746	.13801	61985.6	65773.7	331.858	159.18	196.76	.56093E+00	413	0.00000
580.000	.5482E+01	.31864E+03	.83217	.118757	.12988	65716.8	69729.9	338.799	162.73	198.79	.60460E+00	398	0.00000
600.000	.5179E+01	.30105E+03	.85145	.105447	.12492	69475.4	73723.0	345.568	166.22	200.47	.64540E+00	388	0.00000
620.000	.4901E+01	.28489E+03	.87070	.094376	.12238	73259.0	77747.5	352.165	169.63	201.95	.68333E+00	381	0.00000
640.000	.4648E+01	.27019E+03	.88941	.085142	.12160	77067.7	81800.5	358.599	172.97	203.34	.71840E+00	378	0.00000
660.000	.4419E+01	.25686E+03	.90722	.077397	.12208	80902.9	85881.4	364.877	176.22	204.75	.75069E+00	376	0.00000
680.000	.4211E+01	.24478E+03	.92395	.070853	.12341	84767.1	89991.1	371.012	179.40	206.23	.78034E+00	376	0.00000
700.000	.4023E+01	.23385E+03	.93954	.065277	.12531	88662.9	94131.2	377.012	182.49	207.80	.80754E+00	377	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 25 MPa

Temp. K	Density mol/L	Density kg/m^3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m^3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
138.982	.1277E+02	.74222E+03	1.69422	2.134243	2.44435	160.6	2118.4	134.648	89.17	116.50	.31705E-06	1787	2.04925
140.000	.1275E+02	.74134E+03	1.68391	2.119648	2.42958	276.9	2237.0	135.498	89.05	116.43	.37558E-06	1782	2.04772
150.000	.1260E+02	.73264E+03	1.59029	1.983595	2.29034	1415.4	3398.7	143.510	87.95	115.85	.17279E-05	1736	2.03274
160.000	.1246E+02	.72401E+03	1.50868	1.859386	2.16056	2549.0	4556.0	150.975	87.14	115.53	.64114E-05	1692	2.01786
170.000	.1231E+02	.71543E+03	1.43697	1.745401	2.03892	3680.6	5711.7	157.977	86.65	115.50	.19977E-04	1648	2.00306
180.000	.1216E+02	.70689E+03	1.37353	1.640323	1.92438	4812.9	6868.6	164.585	86.50	115.78	.53904E-04	1604	1.98836
190.000	.1202E+02	.69838E+03	1.31710	1.543067	1.81615	5948.9	8029.6	170.859	86.68	116.36	.12903E-03	1561	1.97373
200.000	.1187E+02	.68989E+03	1.26663	1.452731	1.71358	7091.3	9197.6	176.849	87.17	117.25	.27925E-03	1518	1.95918
210.000	.1172E+02	.68142E+03	1.22132	1.368553	1.61613	8243.1	10375.5	182.597	87.95	118.41	.55484E-03	1475	1.94469
220.000	.1158E+02	.67295E+03	1.18047	1.289892	1.52341	9406.7	11566.0	188.137	88.98	119.82	.10248E-02	1432	1.93026
230.000	.1143E+02	.66448E+03	1.14354	1.216197	1.43506	10584.7	12771.5	193.498	90.23	121.44	.17775E-02	1389	1.91586
240.000	.1129E+02	.65600E+03	1.11006	1.146996	1.35083	11779.2	13994.3	198.704	91.68	123.25	.29200E-02	1347	1.90150
250.000	.1114E+02	.64750E+03	1.07965	1.081883	1.27047	12992.0	15236.2	203.775	93.28	125.21	.45752E-02	1305	1.88716
260.000	.1099E+02	.63897E+03	1.05199	1.020504	1.19381	14224.7	16498.9	208.726	95.01	127.30	.68777E-02	1264	1.87282
270.000	.1085E+02	.63040E+03	1.02679	.962552	1.12069	15478.4	17783.4	213.571	96.85	129.50	.99681E-02	1224	1.85849
280.000	.1070E+02	.62179E+03	1.00384	.907759	1.05099	16753.9	19090.9	218.322	98.78	131.79	.13987E-01	1184	1.84414
290.000	.1055E+02	.61312E+03	.98292	.855890	.98461	18051.8	20421.8	222.987	100.78	134.14	.19069E-01	1144	1.82978
300.000	.1040E+02	.60440E+03	.96387	.806740	.92145	19372.4	21776.6	227.576	102.84	136.55	.25335E-01	1106	1.81538
310.000	.1025E+02	.59561E+03	.94654	.760128	.86143	20715.9	23155.6	232.093	104.93	139.00	.32885E-01	1068	1.80094
320.000	.1009E+02	.58675E+03	.93081	.715897	.80450	22082.3	24558.8	236.545	107.05	141.47	.41799E-01	1031	1.78646
330.000	.9941E+01	.57781E+03	.91656	.673908	.75057	23471.3	25986.1	240.936	109.16	143.93	.52131E-01	994	1.77193
340.000	.9786E+01	.56879E+03	.90371	.634040	.69961	24882.5	27437.3	245.269	111.24	146.34	.63909E-01	959	1.75734
350.000	.9629E+01	.55968E+03	.89218	.596188	.65154	26315.5	28911.8	249.544	113.23	148.66	.77143E-01	924	1.74269
360.000	.9471E+01	.55049E+03	.88188	.560258	.60630	27769.1	30408.8	253.763	115.08	150.82	.91823E-01	891	1.72798
370.000	.9311E+01	.54120E+03	.87277	.526168	.56385	29241.5	31926.5	257.922	116.68	152.73	.10793E+00	859	1.71321
380.000	.9150E+01	.53182E+03	.86479	.493847	.52410	30729.8	33462.1	262.017	117.91	154.25	.12542E+00	828	1.69838
390.000	.8987E+01	.52236E+03	.85789	.463231	.48700	32228.6	35010.5	266.037	118.57	155.17	.14424E+00	798	1.68350
400.000	.8822E+01	.51280E+03	.85203	.434262	.45246	33729.2	36562.8	269.967	118.23	155.08	.16428E+00	770	1.66857
410.000	.8657E+01	.50316E+03	.84717	.406887	.42041	35214.8	38102.7	273.776	115.71	152.78	.18538E+00	745	1.65361
420.000	.8490E+01	.49345E+03	.84328	.381058	.39075	36648.1	39592.9	277.353	102.65	139.91	.20811E+00	729	1.63861
430.000	.8321E+01	.48366E+03	.84033	.356726	.36339	38376.3	41380.7	281.558	145.05	182.46	.23153E+00	676	1.62361
440.000	.8152E+01	.47382E+03	.83830	.333845	.33823	40119.3	43186.1	285.708	142.04	179.57	.25553E+00	653	1.60862
450.000	.7982E+01	.46392E+03	.83715	.312368	.31516	41848.2	44980.4	289.739	141.87	179.49	.28003E+00	631	1.59365
460.000	.7811E+01	.45400E+03	.83685	.292245	.29408	43577.9	46778.6	293.691	142.59	180.26	.30489E+00	609	0.00000
470.000	.7640E+01	.44406E+03	.83739	.273426	.27488	45314.5	48586.8	297.580	143.75	181.43	.32996E+00	589	0.00000
480.000	.7469E+01	.43411E+03	.83872	.255858	.25745	47060.5	50407.8	301.414	145.16	182.81	.35516E+00	569	0.00000
490.000	.7298E+01	.42419E+03	.84083	.239487	.24168	48817.6	52243.2	305.198	146.73	184.30	.38041E+00	550	0.00000
500.000	.7128E+01	.41430E+03	.84368	.224254	.22747	50586.4	54093.8	308.937	148.41	185.84	.40555E+00	533	0.00000
520.000	.6791E+01	.39474E+03	.85143	.196978	.20334	54160.5	57841.7	316.286	151.92	188.93	.45519E+00	502	0.00000
540.000	.6462E+01	.37562E+03	.86163	.173568	.18434	57781.5	61650.1	323.472	155.53	191.89	.50346E+00	476	0.00000
560.000	.6144E+01	.35714E+03	.87384	.153573	.16979	61446.7	65515.4	330.501	159.15	194.60	.54978E+00	455	0.00000
580.000	.5841E+01	.33950E+03	.88756	.136562	.15906	65152.0	69432.1	337.372	162.73	197.02	.59381E+00	438	0.00000
600.000	.5554E+01	.32284E+03	.90223	.122129	.15156	68893.6	73394.6	344.089	166.25	199.18	.63526E+00	426	0.00000
620.000	.5287E+01	.30729E+03	.91732	.109899	.14667	72669.0	77397.8	350.652	169.69	201.12	.67407E+00	416	0.00000
640.000	.5039E+01	.29288E+03	.93238	.099525	.14384	76476.8	81438.3	357.065	173.05	202.91	.71020E+00	410	0.00000
660.000	.4810E+01	.27960E+03	.94706	.090703	.14260	80316.9	85513.9	363.336	176.33	204.64	.74365E+00	406	0.00000
680.000	.4601E+01	.26741E+03	.96110	.083166	.14255	84189.8	89623.7	369.470	179.52	206.34	.77455E+00	404	0.00000
700.000	.4408E+01	.25624E+03	.97436	.076690	.14336	88096.8	93767.7	375.477	182.64	208.06	.80303E+00	404	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 30 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
139.788	.1279E+02	.74355E+03	2.01771	2.139690	2.48616	194.8	2540.0	134.865	89.28	116.35	.42325E-06	1799	2.05127
140.000	.1279E+02	.74337E+03	2.01516	2.136685	2.48312	218.8	2564.5	135.041	89.26	116.33	.43811E-06	1798	2.05096
150.000	.1264E+02	.73480E+03	1.90275	2.001311	2.34455	1352.1	3725.2	143.046	88.16	115.74	.19782E-05	1754	2.03619
160.000	.1250E+02	.72630E+03	1.80472	1.877700	2.21549	2480.4	4881.3	150.503	87.34	115.40	.72212E-05	1710	2.02152
170.000	.1235E+02	.71785E+03	1.71855	1.764255	2.09461	3606.4	6035.5	157.496	86.85	115.35	.22179E-04	1667	2.00696
180.000	.1221E+02	.70945E+03	1.64229	1.659676	1.98088	4732.9	7190.8	164.095	86.70	115.60	.59092E-04	1625	1.99249
190.000	.1206E+02	.70109E+03	1.57441	1.562890	1.87347	5862.8	8350.0	170.359	86.87	116.17	.13986E-03	1582	1.97811
200.000	.1192E+02	.69276E+03	1.51366	1.473005	1.77173	6998.8	9515.9	176.338	87.36	117.03	.29964E-03	1540	1.96382
210.000	.1178E+02	.68446E+03	1.45907	1.389267	1.67515	8143.8	10691.4	182.075	88.14	118.16	.58998E-03	1498	1.94961
220.000	.1163E+02	.67617E+03	1.40982	1.311041	1.58329	9300.4	11879.2	187.602	89.17	119.53	.10808E-02	1456	1.93547
230.000	.1149E+02	.66789E+03	1.36523	1.237780	1.49581	10470.9	13081.7	192.950	90.42	121.12	.18608E-02	1415	1.92139
240.000	.1135E+02	.65962E+03	1.32476	1.169018	1.41243	11657.5	14301.0	198.141	91.86	122.88	.30364E-02	1374	1.90736
250.000	.1121E+02	.65134E+03	1.28794	1.104349	1.33292	12861.9	15539.1	203.196	93.46	124.80	.47286E-02	1334	1.89337
260.000	.1106E+02	.64305E+03	1.25437	1.043424	1.25709	14085.7	16797.4	208.130	95.19	126.85	.70687E-02	1294	1.87942
270.000	.1092E+02	.63474E+03	1.22373	.985935	1.18478	15329.9	18077.1	212.957	97.03	128.99	.10193E-01	1254	1.86549
280.000	.1078E+02	.62640E+03	1.19573	.931615	1.11586	16595.4	19379.1	217.688	98.96	131.22	.14237E-01	1216	1.85158
290.000	.1063E+02	.61804E+03	1.17012	.880231	1.05022	17882.7	20704.1	222.333	100.96	133.51	.19328E-01	1178	1.83767
300.000	.1049E+02	.60964E+03	1.14670	.831577	.98776	19192.0	22052.3	226.899	103.01	135.86	.25579E-01	1141	1.82378
310.000	.1034E+02	.60120E+03	1.12529	.785471	.92839	20523.5	23424.0	231.392	105.10	138.23	.33086E-01	1105	1.80988
320.000	.1020E+02	.59271E+03	1.10573	.741754	.87205	21877.1	24819.0	235.818	107.21	140.62	.41920E-01	1069	1.79597
330.000	.1005E+02	.58418E+03	1.08787	.700286	.81865	23252.5	26237.4	240.182	109.32	142.99	.52129E-01	1034	1.78206
340.000	.9903E+01	.57561E+03	1.07162	.660941	.76814	24649.4	27678.8	244.485	111.39	145.31	.63739E-01	1001	1.76814
350.000	.9755E+01	.56698E+03	1.05684	.623611	.72045	26067.1	29142.6	248.730	113.38	147.54	.76754E-01	968	1.75420
360.000	.9605E+01	.55829E+03	1.04346	.588197	.67551	27504.5	30627.8	252.916	115.22	149.60	.91164E-01	936	1.74025
370.000	.9455E+01	.54956E+03	1.03140	.554612	.63326	28959.8	32132.8	257.040	116.81	151.40	.10695E+00	905	1.72630
380.000	.9304E+01	.54078E+03	1.02056	.522778	.59363	30430.0	33654.5	261.097	118.04	152.81	.12407E+00	876	1.71234
390.000	.9152E+01	.53195E+03	1.01090	.492624	.55653	31909.8	35187.8	265.078	118.68	153.61	.14247E+00	848	1.69839
400.000	.8999E+01	.52308E+03	1.00235	.464086	.52190	33390.4	36724.0	268.968	118.33	153.40	.16205E+00	822	1.68444
410.000	.8846E+01	.51417E+03	.99484	.437102	.48964	34855.1	38246.4	272.733	115.80	150.97	.18266E+00	798	1.67051
420.000	.8692E+01	.50522E+03	.98835	.411617	.45966	36266.6	39718.0	276.265	102.73	137.98	.20487E+00	785	1.65662
430.000	.8538E+01	.49626E+03	.98280	.387575	.43187	37972.1	41485.8	280.424	145.11	180.41	.22775E+00	732	1.64277
440.000	.8383E+01	.48728E+03	.97817	.364923	.40618	39691.6	43270.1	284.525	142.09	177.40	.25120E+00	712	1.62898
450.000	.8229E+01	.47829E+03	.97440	.343609	.38247	41396.4	45042.1	288.506	141.90	177.20	.27517E+00	691	1.61526
460.000	.8074E+01	.46932E+03	.97145	.323579	.36064	43101.3	46816.8	292.406	142.61	177.86	.29951E+00	670	0.00000
470.000	.7920E+01	.46035E+03	.96929	.304780	.34060	44812.7	48600.5	296.242	143.76	178.92	.32409E+00	651	0.00000
480.000	.7767E+01	.45142E+03	.96787	.287157	.32223	46533.0	50395.8	300.022	145.16	180.20	.34885E+00	632	0.00000
490.000	.7614E+01	.44254E+03	.96716	.270657	.30543	48264.4	52204.7	303.752	146.72	181.60	.37369E+00	614	0.00000
500.000	.7462E+01	.43370E+03	.96712	.255223	.29011	50007.5	54028.0	307.435	148.39	183.08	.39849E+00	598	0.00000
520.000	.7162E+01	.41627E+03	.96887	.227337	.26350	53530.9	57719.8	314.675	151.89	186.11	.44766E+00	568	0.00000
540.000	.6869E+01	.39923E+03	.97280	.203065	.24171	57104.3	61472.0	321.754	155.51	189.10	.49577E+00	542	0.00000
560.000	.6584E+01	.38270E+03	.97858	.181991	.22411	60726.8	65283.2	328.685	159.14	191.99	.54226E+00	519	0.00000
580.000	.6310E+01	.36678E+03	.98584	.163726	.21015	64396.3	69150.4	335.470	162.74	194.71	.58679E+00	501	0.00000
600.000	.6048E+01	.35156E+03	.99423	.147913	.19933	68110.5	73070.4	342.114	166.29	197.26	.62908E+00	486	0.00000
620.000	.5800E+01	.33712E+03	1.00339	.134229	.19119	71867.3	77039.7	348.621	169.76	199.65	.66899E+00	474	0.00000
640.000	.5566E+01	.32349E+03	1.01298	.122383	.18530	75664.9	81055.3	354.995	173.15	201.89	.70643E+00	464	0.00000
660.000	.5345E+01	.31070E+03	1.02271	.112114	.18128	79502.3	85114.5	361.241	176.46	204.01	.74136E+00	457	0.00000
680.000	.5140E+01	.29875E+03	1.03235	.103191	.17877	83378.6	89215.4	367.362	179.68	206.06	.77384E+00	452	0.00000
700.000	.4948E+01	.28760E+03	1.04172	.095416	.17747	87293.6	93356.6	373.364	182.82	208.05	.80396E+00	449	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 35 MPa

Temp. K	Density mol/L	Density kg/m^3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m^3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
140.590	.1281E+02	.74486E+03	2.33647	2.145286	2.52792	229.6	2960.8	135.081	89.39	116.20	.57725E-06	1812	2.05326
150.000	.1268E+02	.73691E+03	2.21352	2.018846	2.39838	1291.3	4051.9	142.591	88.35	115.64	.23273E-05	1771	2.03955
160.000	.1253E+02	.72853E+03	2.09906	1.895788	2.26997	2414.5	5206.9	150.041	87.54	115.28	.83577E-05	1728	2.02509
170.000	.1239E+02	.72020E+03	1.99841	1.782839	2.14977	3535.2	6359.9	157.027	87.04	115.21	.25304E-04	1686	2.01074
180.000	.1225E+02	.71194E+03	1.90931	1.678713	2.03676	4656.2	7513.7	163.617	86.89	115.45	.66565E-04	1645	1.99649
190.000	.1211E+02	.70372E+03	1.82994	1.582351	1.93010	5780.3	8671.2	169.872	87.06	115.99	.15577E-03	1603	1.98235
200.000	.1197E+02	.69554E+03	1.75889	1.492867	1.82912	6910.3	9835.2	175.842	87.55	116.83	.33037E-03	1562	1.96831
210.000	.1183E+02	.68739E+03	1.69499	1.409518	1.73331	8049.1	11008.6	181.567	88.32	117.93	.64457E-03	1521	1.95435
220.000	.1169E+02	.67927E+03	1.63728	1.331671	1.64223	9199.1	12194.0	187.084	89.35	119.28	.11711E-02	1480	1.94048
230.000	.1155E+02	.67117E+03	1.58500	1.258787	1.55553	10362.7	13393.7	192.419	90.60	120.83	.20014E-02	1440	1.92669
240.000	.1141E+02	.66309E+03	1.53748	1.190399	1.47291	11542.0	14610.0	197.598	92.04	122.56	.32438E-02	1400	1.91296
250.000	.1127E+02	.65501E+03	1.49418	1.126107	1.39416	12738.8	15844.7	202.639	93.64	124.44	.50205E-02	1361	1.89930
260.000	.1113E+02	.64693E+03	1.45465	1.065561	1.31906	13954.6	17099.2	207.558	95.37	126.45	.74630E-02	1322	1.88568
270.000	.1099E+02	.63885E+03	1.41850	1.008455	1.24746	15190.4	18374.8	212.370	97.20	128.55	.10707E-01	1284	1.87212
280.000	.1085E+02	.63076E+03	1.38538	.954524	1.17922	16447.0	19672.2	217.084	99.13	130.73	.14884E-01	1247	1.85859
290.000	.1071E+02	.62266E+03	1.35501	.903533	1.11421	17724.8	20992.1	221.711	101.12	132.98	.20119E-01	1210	1.84510
300.000	.1057E+02	.61454E+03	1.32715	.855275	1.05234	19024.3	22334.7	226.257	103.17	135.27	.26522E-01	1174	1.83164
310.000	.1043E+02	.60640E+03	1.30157	.809568	.99352	20345.4	23700.1	230.730	105.26	137.59	.34182E-01	1139	1.81820
320.000	.1029E+02	.59824E+03	1.27809	.766251	.93766	21687.9	25088.5	235.135	107.37	139.91	.43165E-01	1105	1.80479
330.000	.1015E+02	.59006E+03	1.25656	.725181	.88469	23051.8	26499.5	239.476	109.48	142.22	.53516E-01	1072	1.79140
340.000	.1001E+02	.58185E+03	1.23681	.686231	.83453	24436.5	27932.9	243.756	111.54	144.48	.65253E-01	1039	1.77803
350.000	.9869E+01	.57361E+03	1.21872	.649288	.78712	25841.4	29388.0	247.975	113.52	146.64	.78379E-01	1008	1.76469
360.000	.9727E+01	.56535E+03	1.20218	.614249	.74239	27265.5	30863.9	252.135	115.36	148.63	.92880E-01	978	1.75137
370.000	.9584E+01	.55706E+03	1.18709	.581023	.70026	28706.8	32358.7	256.231	116.95	150.36	.10873E+00	948	1.73807
380.000	.9441E+01	.54876E+03	1.17335	.549528	.66066	30162.4	33869.6	260.260	118.16	151.69	.12591E+00	920	1.72481
390.000	.9298E+01	.54043E+03	1.16088	.519687	.62352	31627.1	35391.4	264.211	118.80	152.42	.14434E+00	894	1.71159
400.000	.9154E+01	.53209E+03	1.14960	.491431	.58874	33091.9	36915.2	268.069	118.44	152.13	.16392E+00	869	1.69841
410.000	.9011E+01	.52374E+03	1.13944	.464695	.55625	34540.3	38424.6	271.802	115.90	149.63	.18452E+00	847	1.68528
420.000	.8867E+01	.51538E+03	1.13034	.439416	.52595	35935.1	39882.4	275.301	102.83	136.57	.20671E+00	835	1.67222
430.000	.8723E+01	.50703E+03	1.12224	.415537	.49776	37623.4	41635.7	279.425	145.20	178.92	.22955E+00	783	1.65924
440.000	.8580E+01	.49869E+03	1.11508	.393000	.47157	39325.4	43404.8	283.492	142.16	175.84	.25296E+00	763	1.64633
450.000	.8436E+01	.49037E+03	1.10881	.371750	.44729	41012.2	45160.9	287.437	141.97	175.58	.27688E+00	743	1.63353
460.000	.8294E+01	.48207E+03	1.10337	.351731	.42482	42699.0	46919.1	291.300	142.67	176.18	.30118E+00	724	0.00000
470.000	.8152E+01	.47381E+03	1.09872	.332889	.40406	44392.1	48685.7	295.100	143.81	177.19	.32572E+00	705	0.00000
480.000	.8010E+01	.46560E+03	1.09481	.315171	.38491	46094.1	50463.4	298.843	145.21	178.42	.35046E+00	687	0.00000
490.000	.7870E+01	.45744E+03	1.09160	.298522	.36727	47807.1	52254.4	302.535	146.76	179.79	.37531E+00	670	0.00000
500.000	.7731E+01	.44934E+03	1.08904	.282890	.35105	49532.0	54059.4	306.182	148.42	181.23	.40014E+00	654	0.00000
520.000	.7456E+01	.43339E+03	1.08570	.254465	.32250	53019.8	57713.9	313.348	151.92	184.23	.44946E+00	625	0.00000
540.000	.7188E+01	.41781E+03	1.08448	.229486	.29859	56559.5	61428.7	320.358	155.53	187.25	.49787E+00	599	0.00000
560.000	.6928E+01	.40267E+03	1.08507	.207567	.27872	60151.1	65203.3	327.221	159.17	190.20	.54482E+00	577	0.00000
580.000	.6676E+01	.38804E+03	1.08715	.188346	.26236	63793.4	69036.1	333.946	162.79	193.06	.58999E+00	557	0.00000
600.000	.6434E+01	.37397E+03	1.09045	.171495	.24906	67484.9	72924.8	340.537	166.35	195.79	.63307E+00	541	0.00000
620.000	.6202E+01	.36051E+03	1.09467	.156718	.23842	71223.9	76866.9	347.000	169.84	198.40	.67393E+00	527	0.00000
640.000	.5982E+01	.34768E+03	1.09958	.143750	.23006	75008.8	80860.0	353.338	173.25	200.89	.71245E+00	516	0.00000
660.000	.5772E+01	.33552E+03	1.10492	.132358	.22366	78838.4	84901.7	359.556	176.57	203.26	.74853E+00	507	0.00000
680.000	.5574E+01	.32401E+03	1.11050	.122332	.21892	82711.3	88989.9	365.659	179.81	205.54	.78225E+00	500	0.00000
700.000	.5388E+01	.31316E+03	1.11615	.113490	.21557	86626.8	93122.9	371.649	182.96	207.75	.81364E+00	494	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 40 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	Cv J/(mol•K)	Cp J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
141.385	.1284E+02	.74615E+03	2.65063	2.151011	2.56963	265.0	3380.9	135.296	89.49	116.06	.79834E-06	1825	2.05521
150.000	.1271E+02	.73897E+03	2.52268	2.036203	2.45186	1232.6	4378.8	142.145	88.55	115.54	.27925E-05	1788	2.04283
160.000	.1257E+02	.73070E+03	2.39178	1.913658	2.32402	2350.9	5532.8	149.589	87.73	115.17	.98658E-05	1746	2.02857
170.000	.1243E+02	.72250E+03	2.27664	1.801164	2.20444	3466.6	6684.6	156.567	87.23	115.09	.29443E-04	1705	2.01442
180.000	.1229E+02	.71436E+03	2.17467	1.697450	2.09207	4582.4	7837.1	163.150	87.07	115.31	.76474E-04	1664	2.00038
190.000	.1215E+02	.70627E+03	2.08380	1.601468	1.98608	5701.2	8993.1	169.397	87.24	115.83	.17694E-03	1623	1.98646
200.000	.1201E+02	.69823E+03	2.00241	1.512344	1.88580	6825.6	10155.4	175.358	87.73	116.65	.37146E-03	1583	1.97265
210.000	.1188E+02	.69023E+03	1.92916	1.429337	1.79068	7958.5	11326.9	181.074	88.50	117.73	.71816E-03	1543	1.95893
220.000	.1174E+02	.68226E+03	1.86297	1.351823	1.70030	9102.4	12510.1	186.580	89.52	119.05	.12941E-02	1503	1.94531
230.000	.1160E+02	.67433E+03	1.80295	1.279263	1.61430	10259.6	13707.4	191.905	90.77	120.58	.21950E-02	1464	1.93178
240.000	.1147E+02	.66641E+03	1.74834	1.211197	1.53237	11432.3	14921.1	197.072	92.21	122.28	.35335E-02	1425	1.91833
250.000	.1133E+02	.65852E+03	1.69854	1.147223	1.45429	12622.1	16152.8	202.101	93.80	124.13	.54351E-02	1387	1.90496
260.000	.1119E+02	.65063E+03	1.65299	1.086995	1.37985	13830.6	17404.0	207.007	95.53	126.10	.80337E-02	1349	1.89166
270.000	.1106E+02	.64276E+03	1.61127	1.030209	1.30887	15058.7	18675.9	211.805	97.37	128.17	.11466E-01	1312	1.87842
280.000	.1092E+02	.63489E+03	1.57298	.976596	1.24122	16307.3	19969.3	216.505	99.29	130.31	.15864E-01	1276	1.86524
290.000	.1079E+02	.62702E+03	1.53780	.925924	1.17677	17576.8	21284.8	221.116	101.28	132.52	.21350E-01	1240	1.85211
300.000	.1065E+02	.61915E+03	1.50544	.877985	1.11541	18867.5	22622.6	225.646	103.33	134.77	.28031E-01	1206	1.83903
310.000	.1052E+02	.61128E+03	1.47564	.832595	1.05704	20179.3	23982.8	230.102	105.42	137.04	.35994E-01	1172	1.82600
320.000	.1038E+02	.60340E+03	1.44819	.789591	1.00159	21512.3	25365.5	234.489	107.52	139.32	.45300E-01	1139	1.81302
330.000	.1025E+02	.59551E+03	1.42291	.748829	.94896	22866.2	26770.3	238.811	109.62	141.58	.55987E-01	1107	1.80008
340.000	.1011E+02	.58762E+03	1.39961	.710179	.89909	24240.4	28197.0	243.071	111.69	143.79	.68071E-01	1075	1.78719
350.000	.9974E+01	.57971E+03	1.37816	.673525	.85189	25634.5	29645.0	247.270	113.66	145.90	.81548E-01	1045	1.77435
360.000	.9838E+01	.57181E+03	1.35841	.638761	.80730	27047.2	31113.2	251.407	115.49	147.84	.96403E-01	1016	1.76155
370.000	.9701E+01	.56389E+03	1.34025	.605794	.76524	28476.8	32599.9	255.482	117.08	149.51	.11261E+00	988	1.74880
380.000	.9565E+01	.55597E+03	1.32356	.574537	.72563	29920.3	34102.1	259.487	118.29	150.80	.13013E+00	961	1.73611
390.000	.9429E+01	.54806E+03	1.30825	.544910	.68840	31372.5	35614.7	263.414	118.92	151.47	.14890E+00	936	1.72349
400.000	.9293E+01	.54014E+03	1.29423	.516840	.65346	32824.5	37128.8	267.248	118.56	151.13	.16882E+00	912	1.71093
410.000	.9157E+01	.53224E+03	1.28142	.490259	.62074	34259.8	38628.0	270.956	116.01	148.59	.18974E+00	891	1.69845
420.000	.9021E+01	.52435E+03	1.26973	.465102	.59013	35641.1	40075.1	274.429	102.93	135.48	.21227E+00	881	1.68605
430.000	.8886E+01	.51648E+03	1.25910	.441308	.56155	37315.7	41817.3	278.527	145.30	177.79	.23542E+00	828	1.67374
440.000	.8751E+01	.50863E+03	1.24946	.418817	.53491	39003.9	43574.9	282.567	142.25	174.67	.25915E+00	810	1.66154
450.000	.8616E+01	.50082E+03	1.24075	.397573	.51012	40676.7	45319.0	286.485	142.05	174.37	.28337E+00	791	1.64945
460.000	.8483E+01	.49305E+03	1.23292	.377519	.48707	42349.4	47064.9	290.322	142.75	174.93	.30797E+00	772	0.00000
470.000	.8350E+01	.48532E+03	1.22589	.358602	.46568	44028.4	48819.0	294.095	143.88	175.91	.33281E+00	754	0.00000
480.000	.8218E+01	.47765E+03	1.21964	.340767	.44585	45716.4	50583.9	297.810	145.28	177.13	.35784E+00	737	0.00000
490.000	.8087E+01	.47004E+03	1.21409	.323962	.42749	47415.5	52361.8	301.476	146.83	178.47	.38299E+00	720	0.00000
500.000	.7957E+01	.46250E+03	1.20922	.308136	.41050	49126.5	54153.6	305.096	148.48	179.91	.40813E+00	705	0.00000
520.000	.7701E+01	.44764E+03	1.20128	.279220	.38033	52587.6	57781.4	312.210	151.97	182.89	.45809E+00	676	0.00000
540.000	.7452E+01	.43315E+03	1.19551	.253629	.35468	56101.9	61469.6	319.169	155.59	185.93	.50719E+00	651	0.00000
560.000	.7210E+01	.41906E+03	1.19158	.230996	.33298	59670.1	65218.2	325.985	159.23	188.93	.55489E+00	628	0.00000
580.000	.6975E+01	.40541E+03	1.18921	.210985	.31473	63291.4	69026.2	332.666	162.85	191.86	.60089E+00	608	0.00000
600.000	.6748E+01	.39225E+03	1.18814	.193288	.29948	66964.6	72891.8	339.218	166.41	194.69	.64487E+00	591	0.00000
620.000	.6531E+01	.37960E+03	1.18812	.177626	.28685	70688.4	76813.1	345.647	169.91	197.42	.68668E+00	577	0.00000
640.000	.6322E+01	.36749E+03	1.18894	.163752	.27650	74461.3	80787.9	351.956	173.34	200.05	.72621E+00	564	0.00000
660.000	.6123E+01	.35592E+03	1.19039	.151446	.26814	78282.1	84814.4	358.151	176.67	202.58	.76334E+00	554	0.00000
680.000	.5934E+01	.34490E+03	1.19230	.140515	.26150	82149.3	88890.4	364.235	179.92	205.01	.79812E+00	545	0.00000
700.000	.5754E+01	.33442E+03	1.19451	.130787	.25633	86062.0	93014.2	370.212	183.08	207.36	.83059E+00	538	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 50 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	C_v J/(mol•K)	C_p J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
142.960	.1288E+02	.74868E+03	3.26571	2.162776	2.65286	337.3	4219.1	135.721	89.67	115.81	.15657E-05	1850	2.05902
150.000	.1278E+02	.74296E+03	3.13641	2.070390	2.55781	1121.4	5033.0	141.277	88.91	115.38	.41903E-05	1821	2.04916
160.000	.1264E+02	.73491E+03	2.97261	1.948762	2.43092	2230.7	6185.2	148.709	88.08	114.98	.14327E-04	1781	2.03526
170.000	.1251E+02	.72693E+03	2.82846	1.837070	2.31237	3337.1	7335.0	155.675	87.58	114.87	.41543E-04	1741	2.02149
180.000	.1237E+02	.71902E+03	2.70072	1.734074	2.20111	4443.3	8485.2	162.245	87.42	115.06	.10518E-03	1702	2.00784
190.000	.1224E+02	.71117E+03	2.58681	1.638746	2.09627	5552.1	9638.6	168.478	87.58	115.56	.23789E-03	1663	1.99432
200.000	.1210E+02	.70338E+03	2.48468	1.550226	1.99717	6666.3	10798.1	174.424	88.06	116.34	.48934E-03	1624	1.98093
210.000	.1197E+02	.69564E+03	2.39268	1.467790	1.90326	7788.5	11966.3	180.124	88.83	117.38	.92885E-03	1585	1.96765
220.000	.1184E+02	.68796E+03	2.30945	1.390819	1.81408	8921.4	13145.8	185.614	89.85	118.66	.16462E-02	1547	1.95448
230.000	.1170E+02	.68031E+03	2.23387	1.318783	1.72927	10067.2	14339.1	190.920	91.10	120.15	.27505E-02	1510	1.94142
240.000	.1157E+02	.67270E+03	2.16500	1.251227	1.64853	11228.0	15548.2	196.068	92.53	121.80	.43674E-02	1473	1.92847
250.000	.1144E+02	.66513E+03	2.10206	1.187753	1.57160	12405.5	16774.9	201.077	94.12	123.61	.66341E-02	1436	1.91561
260.000	.1131E+02	.65759E+03	2.04440	1.128017	1.49826	13601.1	18020.6	205.962	95.85	125.53	.96942E-02	1400	1.90285
270.000	.1118E+02	.65007E+03	1.99144	1.071714	1.42833	14815.9	19286.5	210.737	97.68	127.54	.13691E-01	1365	1.89017
280.000	.1106E+02	.64258E+03	1.94271	1.018579	1.36166	16050.6	20573.4	215.412	99.60	129.63	.18760E-01	1331	1.87759
290.000	.1093E+02	.63511E+03	1.89778	.968377	1.29812	17305.7	21881.7	219.999	101.59	131.77	.25025E-01	1297	1.86508
300.000	.1080E+02	.62766E+03	1.85630	.920900	1.23759	18581.4	23211.7	224.503	103.63	133.96	.32588E-01	1264	1.85265
310.000	.1067E+02	.62023E+03	1.81794	.875961	1.17996	19877.8	24563.5	228.931	105.71	136.17	.41529E-01	1232	1.84031
320.000	.1054E+02	.61281E+03	1.78244	.833396	1.12514	21194.7	25937.1	233.289	107.81	138.38	.51903E-01	1201	1.82804
330.000	.1042E+02	.60541E+03	1.74955	.793056	1.07305	22531.9	27332.3	237.581	109.91	140.58	.63735E-01	1171	1.81584
340.000	.1029E+02	.59803E+03	1.71906	.754808	1.02359	23889.0	28748.7	241.810	111.96	142.72	.77030E-01	1142	1.80373
350.000	.1016E+02	.59066E+03	1.69077	.718532	.97668	25265.3	30185.6	245.977	113.93	144.76	.91773E-01	1113	1.79169
360.000	.1004E+02	.58332E+03	1.66451	.684118	.93226	26659.8	31642.0	250.081	115.76	146.63	.10794E+00	1086	1.77973
370.000	.9910E+01	.57599E+03	1.64012	.651469	.89024	28070.7	33116.3	254.122	117.33	148.24	.12549E+00	1060	1.76785
380.000	.9784E+01	.56868E+03	1.61748	.620491	.85055	29495.0	34605.4	258.092	118.54	149.46	.14438E+00	1035	1.75606
390.000	.9659E+01	.56140E+03	1.59645	.591103	.81310	30927.6	36104.3	261.984	119.16	150.07	.16455E+00	1011	1.74436
400.000	.9534E+01	.55414E+03	1.57692	.563226	.77782	32359.6	37604.1	265.781	118.79	149.67	.18587E+00	989	1.73276
410.000	.9409E+01	.54692E+03	1.55878	.536788	.74463	33774.6	39088.4	269.452	116.24	147.07	.20818E+00	970	1.72125
420.000	.9286E+01	.53973E+03	1.54195	.511720	.71343	35135.5	40520.1	272.888	103.15	133.91	.23216E+00	962	1.70985
430.000	.9163E+01	.53257E+03	1.52631	.487960	.68415	36789.4	42246.3	276.949	145.51	176.17	.25674E+00	910	1.69857
440.000	.9040E+01	.52546E+03	1.51181	.465444	.65671	38456.7	43987.5	280.951	142.45	173.01	.28186E+00	893	1.68740
450.000	.8919E+01	.51840E+03	1.49835	.444116	.63101	40108.7	45714.9	284.832	142.25	172.67	.30745E+00	875	1.67635
460.000	.8798E+01	.51139E+03	1.48588	.423920	.60696	41760.6	47443.6	288.630	142.94	173.21	.33338E+00	857	0.00000
470.000	.8679E+01	.50443E+03	1.47432	.404800	.58449	43418.9	49180.2	292.366	144.06	174.16	.35953E+00	840	0.00000
480.000	.8560E+01	.49754E+03	1.46360	.386705	.56351	45086.4	50927.6	296.044	145.45	175.36	.38585E+00	824	0.00000
490.000	.8442E+01	.49071E+03	1.45369	.369586	.54394	46765.2	52687.7	299.673	146.99	176.69	.41226E+00	808	0.00000
500.000	.8326E+01	.48395E+03	1.44451	.353391	.52568	48456.4	54461.6	303.257	148.64	178.12	.43863E+00	793	0.00000
520.000	.8097E+01	.47066E+03	1.42818	.323593	.49284	51879.0	58053.8	310.301	152.13	181.12	.49101E+00	765	0.00000
540.000	.7874E+01	.45770E+03	1.41423	.296951	.46438	55357.1	61706.7	317.194	155.73	184.19	.54245E+00	741	0.00000
560.000	.7658E+01	.44509E+03	1.40235	.273133	.43978	58891.6	65421.1	323.948	159.38	187.25	.59244E+00	718	0.00000
580.000	.7447E+01	.43286E+03	1.39224	.251833	.41855	62482.3	69196.3	330.571	163.00	190.26	.64067E+00	698	0.00000
600.000	.7244E+01	.42103E+03	1.38366	.232771	.40029	66128.4	73031.1	337.071	166.57	193.20	.68682E+00	681	0.00000
620.000	.7047E+01	.40960E+03	1.37637	.215695	.38462	69828.7	76923.9	343.453	170.09	196.07	.73076E+00	665	0.00000
640.000	.6858E+01	.39860E+03	1.37018	.200382	.37123	73582.0	80873.1	349.721	173.52	198.84	.77238E+00	652	0.00000
660.000	.6676E+01	.38801E+03	1.36490	.186629	.35984	77387.1	84877.1	355.882	176.87	201.53	.81152E+00	640	0.00000
680.000	.6501E+01	.37785E+03	1.36039	.174259	.35021	81242.5	88933.9	361.937	180.13	204.14	.84826E+00	629	0.00000
700.000	.6333E+01	.36811E+03	1.35649	.163114	.34214	85147.0	93042.0	367.891	183.31	206.66	.88261E+00	621	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 60 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	Cv J/(mol•K)	Cp J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
144.515	.1292E+02	.75114E+03	3.86400	2.174865	2.73581	411.6	5054.5	136.140	89.83	115.57	.31218E-05	1876	2.06269
150.000	.1285E+02	.74680E+03	3.74438	2.103892	2.66254	1017.8	5687.7	140.439	89.25	115.24	.65280E-05	1854	2.05520
160.000	.1271E+02	.73894E+03	3.54769	1.983055	2.53636	2118.8	6838.4	147.862	88.42	114.83	.21601E-04	1814	2.04164
170.000	.1258E+02	.73116E+03	3.37453	1.872043	2.41861	3216.8	7986.5	154.818	87.91	114.69	.60852E-04	1776	2.02821
180.000	.1245E+02	.72345E+03	3.22099	1.769642	2.30822	4314.3	9134.8	161.377	87.74	114.86	.15018E-03	1738	2.01491
190.000	.1232E+02	.71582E+03	3.08400	1.674844	2.20430	5414.1	10286.1	167.598	87.90	115.33	.33200E-03	1700	2.00176
200.000	.1219E+02	.70826E+03	2.96110	1.586807	2.10616	6519.1	11443.1	173.532	88.38	116.08	.66911E-03	1663	1.98873
210.000	.1206E+02	.70075E+03	2.85029	1.504813	2.01323	7631.9	12608.7	179.219	89.14	117.10	.12469E-02	1626	1.97583
220.000	.1193E+02	.69331E+03	2.74995	1.428256	1.92504	8755.1	13785.3	184.695	90.16	118.35	.21733E-02	1589	1.96307
230.000	.1180E+02	.68591E+03	2.65874	1.356611	1.84122	9890.9	14975.3	189.987	91.40	119.80	.35765E-02	1553	1.95042
240.000	.1167E+02	.67857E+03	2.57554	1.289426	1.76144	11041.3	16180.7	195.119	92.83	121.43	.56010E-02	1517	1.93789
250.000	.1155E+02	.67127E+03	2.49940	1.226308	1.68543	12208.2	17403.5	200.112	94.42	123.19	.84011E-02	1482	1.92548
260.000	.1142E+02	.66402E+03	2.42952	1.166914	1.61299	13392.8	18644.9	204.980	96.14	125.07	.12135E-01	1448	1.91317
270.000	.1130E+02	.65680E+03	2.36524	1.110941	1.54390	14596.3	19906.1	209.737	97.97	127.05	.16956E-01	1414	1.90098
280.000	.1118E+02	.64962E+03	2.30597	1.058125	1.47802	15819.3	21187.8	214.394	99.88	129.10	.23007E-01	1382	1.88888
290.000	.1105E+02	.64248E+03	2.25120	1.008229	1.41520	17062.4	22490.5	218.961	101.87	131.20	.30413E-01	1350	1.87689
300.000	.1093E+02	.63537E+03	2.20050	.961045	1.35531	18325.8	23814.6	223.445	103.91	133.34	.39275E-01	1318	1.86500
310.000	.1081E+02	.62830E+03	2.15350	.916385	1.29825	19609.4	25160.1	227.852	105.98	135.51	.49665E-01	1288	1.85320
320.000	.1069E+02	.62126E+03	2.10985	.874083	1.24390	20913.3	26526.8	232.189	108.08	137.68	.61625E-01	1258	1.84151
330.000	.1057E+02	.61425E+03	2.06927	.833988	1.19219	22237.1	27914.7	236.458	110.17	139.83	.75170E-01	1230	1.82990
340.000	.1045E+02	.60727E+03	2.03149	.795964	1.14301	23580.5	29323.4	240.664	112.22	141.93	.90288E-01	1202	1.81840
350.000	.1033E+02	.60032E+03	1.99629	.759890	1.09629	24942.8	30752.2	244.807	114.19	143.92	.10695E+00	1175	1.80699
360.000	.1021E+02	.59340E+03	1.96345	.725653	1.05195	26323.1	32200.1	248.888	116.01	145.75	.12512E+00	1149	1.79568
370.000	.1009E+02	.58652E+03	1.93280	.693151	1.00990	27719.5	33665.5	252.903	117.58	147.32	.14473E+00	1124	1.78447
380.000	.9973E+01	.57968E+03	1.90416	.662291	.97007	29129.0	35145.3	256.849	118.78	148.50	.16575E+00	1101	1.77336
390.000	.9856E+01	.57287E+03	1.87738	.632987	.93239	30546.7	36634.4	260.716	119.40	149.08	.18808E+00	1078	1.76236
400.000	.9739E+01	.56610E+03	1.85234	.605158	.89677	31963.7	38124.2	264.487	119.03	148.65	.21159E+00	1058	1.75146
410.000	.9624E+01	.55937E+03	1.82889	.578730	.86314	33363.6	39598.2	268.133	116.46	146.02	.23610E+00	1040	1.74068
420.000	.9509E+01	.55269E+03	1.80693	.553635	.83141	34709.2	41019.2	271.543	103.37	132.83	.26238E+00	1033	1.73001
430.000	.9395E+01	.54606E+03	1.78635	.529805	.80152	36348.0	42734.6	275.578	145.72	175.08	.28920E+00	981	1.71946
440.000	.9281E+01	.53947E+03	1.76706	.507181	.77337	38000.1	44464.7	279.555	142.67	171.89	.31652E+00	965	1.70903
450.000	.9169E+01	.53294E+03	1.74896	.485702	.74689	39637.0	46180.8	283.411	142.45	171.54	.34428E+00	948	1.69873
460.000	.9058E+01	.52647E+03	1.73198	.465313	.72200	41273.9	47898.2	287.184	143.14	172.07	.37232E+00	931	0.00000
470.000	.8947E+01	.52005E+03	1.71604	.445962	.69862	42917.4	49623.4	290.895	144.26	173.01	.40051E+00	915	0.00000
480.000	.8838E+01	.51370E+03	1.70107	.427596	.67668	44570.3	51359.2	294.550	145.64	174.21	.42883E+00	899	0.00000
490.000	.8730E+01	.50742E+03	1.68699	.410168	.65609	46234.9	53107.9	298.155	147.18	175.54	.45719E+00	884	0.00000
500.000	.8623E+01	.50120E+03	1.67376	.393630	.63679	47912.1	54870.3	301.716	148.83	176.98	.48545E+00	870	0.00000
520.000	.8413E+01	.48898E+03	1.64959	.363047	.60176	51307.8	58439.8	308.715	152.31	179.99	.54142E+00	843	0.00000
540.000	.8208E+01	.47707E+03	1.62815	.335509	.57103	54760.5	62070.6	315.566	155.91	183.10	.59623E+00	818	0.00000
560.000	.8008E+01	.46549E+03	1.60908	.310705	.54410	58271.6	65763.6	322.281	159.55	186.20	.64935E+00	796	0.00000
580.000	.7815E+01	.45423E+03	1.59208	.288351	.52053	61840.8	69518.5	328.869	163.17	189.27	.70048E+00	777	0.00000
600.000	.7627E+01	.44333E+03	1.57686	.268187	.49992	65467.6	73334.1	335.336	166.75	192.28	.74933E+00	759	0.00000
620.000	.7446E+01	.43278E+03	1.56321	.249980	.48191	69150.9	77209.2	341.689	170.27	195.22	.79576E+00	743	0.00000
640.000	.7270E+01	.42258E+03	1.55090	.233519	.46619	72889.5	81142.2	347.931	173.71	198.07	.83966E+00	729	0.00000
660.000	.7101E+01	.41274E+03	1.53975	.218616	.45251	76682.1	85131.6	354.069	177.06	200.85	.88090E+00	716	0.00000
680.000	.6938E+01	.40326E+03	1.52962	.205103	.44061	80527.3	89175.6	360.105	180.33	203.54	.91956E+00	705	0.00000
700.000	.6781E+01	.39412E+03	1.52036	.192832	.43031	84423.9	93272.6	366.043	183.52	206.15	.95566E+00	695	0.00000

Table 21. (Continued)

Normal Butane Isobar at P = 70 MPa

Temp. K	Density mol/L	Density kg/m3	Z	Isochore Derivative MPa/K	Isotherm Derivative MPa•m3/kg	Internal Energy J/mol	Enthalpy J/mol	Entropy J/(mol•K)	Cv J/(mol•K)	Cp J/(mol•K)	Fugacity/ Pressure Ratio	Vel. of Sound m/s	Dielectric Constant
146.050	.1296E+02	.75354E+03	4.44645	2.187177	2.81846	487.7	5887.2	136.553	89.99	115.36	.62576E-05	1900	2.06625
150.000	.1291E+02	.75048E+03	4.34700	2.136725	2.76616	921.1	6342.6	139.629	89.57	115.12	.10428E-04	1885	2.06098
160.000	.1278E+02	.74280E+03	4.11745	2.016573	2.64048	2014.5	7492.0	147.044	88.74	114.69	.33391E-04	1847	2.04772
170.000	.1265E+02	.73520E+03	3.91528	1.906138	2.52333	3104.6	8638.8	153.991	88.22	114.55	.91392E-04	1810	2.03461
180.000	.1252E+02	.72769E+03	3.73595	1.804233	2.41361	4194.2	9785.5	160.541	88.05	114.69	.21985E-03	1773	2.02163
190.000	.1239E+02	.72025E+03	3.57587	1.709867	2.31042	5286.0	10935.0	166.753	88.20	115.14	.47504E-03	1736	2.00880
200.000	.1226E+02	.71289E+03	3.43217	1.622211	2.21305	6382.7	12090.0	172.677	88.68	115.88	.93795E-03	1700	1.99611
210.000	.1214E+02	.70559E+03	3.30254	1.540561	2.12091	7487.0	13253.4	178.353	89.43	116.87	.17158E-02	1664	1.98356
220.000	.1201E+02	.69836E+03	3.18507	1.464315	2.03352	8601.5	14427.6	183.817	90.45	118.10	.29409E-02	1629	1.97114
230.000	.1189E+02	.69119E+03	3.07819	1.392956	1.95050	9728.4	15614.9	189.098	91.69	119.52	.47667E-02	1594	1.95886
240.000	.1177E+02	.68407E+03	2.98061	1.326037	1.87151	10869.7	16817.5	194.218	93.11	121.12	.73618E-02	1560	1.94671
250.000	.1165E+02	.67702E+03	2.89122	1.263166	1.79627	12027.2	18037.0	199.197	94.70	122.86	.10903E-01	1526	1.93468
260.000	.1153E+02	.67001E+03	2.80909	1.204004	1.72455	13202.3	19274.9	204.051	96.41	124.71	.15565E-01	1493	1.92277
270.000	.1141E+02	.66305E+03	2.73343	1.148249	1.65615	14396.0	20532.3	208.794	98.24	126.66	.21516E-01	1461	1.91098
280.000	.1129E+02	.65614E+03	2.66357	1.095636	1.59091	15609.1	21810.0	213.437	100.15	128.67	.28906E-01	1429	1.89931
290.000	.1117E+02	.64928E+03	2.59891	1.045930	1.52866	16841.9	23108.4	217.988	102.13	130.75	.37862E-01	1398	1.88776
300.000	.1105E+02	.64246E+03	2.53895	.998922	1.46928	18094.8	24427.8	222.456	104.17	132.86	.48479E-01	1368	1.87631
310.000	.1094E+02	.63568E+03	2.48324	.954423	1.41266	19367.8	25768.3	226.848	106.24	135.00	.60821E-01	1339	1.86498
320.000	.1082E+02	.62894E+03	2.43140	.912266	1.35868	20660.7	27129.8	231.167	108.34	137.14	.74916E-01	1311	1.85375
330.000	.1071E+02	.62225E+03	2.38309	.872298	1.30724	21973.5	28512.1	235.420	110.42	139.26	.90760E-01	1283	1.84264
340.000	.1059E+02	.61560E+03	2.33799	.834384	1.25827	23305.6	29914.9	239.608	112.47	141.33	.10832E+00	1257	1.83163
350.000	.1048E+02	.60899E+03	2.29584	.798398	1.21166	24656.5	31337.6	243.733	114.44	143.29	.12755E+00	1231	1.82073
360.000	.1036E+02	.60242E+03	2.25641	.764228	1.16735	26025.1	32779.1	247.796	116.25	145.10	.14839E+00	1207	1.80994
370.000	.1025E+02	.59590E+03	2.21946	.731770	1.12524	27409.8	34237.7	251.793	117.82	146.64	.17077E+00	1183	1.79926
380.000	.1014E+02	.58941E+03	2.18482	.700928	1.08526	28807.6	35710.6	255.720	119.02	147.80	.19461E+00	1160	1.78869
390.000	.1003E+02	.58298E+03	2.15230	.671615	1.04735	30213.4	37192.6	259.568	119.63	148.36	.21983E+00	1139	1.77824
400.000	.9920E+01	.57659E+03	2.12174	.643751	1.01141	31618.5	38675.0	263.321	119.25	147.91	.24625E+00	1120	1.76790
410.000	.9811E+01	.57025E+03	2.09301	.617259	.97738	33006.5	40141.4	266.948	116.69	145.26	.27368E+00	1103	1.75767
420.000	.9703E+01	.56396E+03	2.06596	.592070	.94517	34340.2	41554.7	270.340	103.59	132.05	.30299E+00	1097	1.74757
430.000	.9595E+01	.55772E+03	2.04048	.568116	.91473	35967.1	43262.3	274.357	145.94	174.29	.33279E+00	1045	1.73759
440.000	.9489E+01	.55154E+03	2.01646	.545338	.88596	37607.5	44984.5	278.315	142.88	171.10	.36301E+00	1030	1.72773
450.000	.9384E+01	.54541E+03	1.99380	.523675	.85880	39232.8	46692.6	282.153	142.66	170.74	.39361E+00	1013	1.71800
460.000	.9279E+01	.53934E+03	1.97240	.503072	.83318	40858.2	48402.0	285.909	143.34	171.26	.42441E+00	997	0.00000
470.000	.9176E+01	.53334E+03	1.95218	.483478	.80902	42490.4	50119.1	289.602	144.46	172.21	.45529E+00	982	0.00000
480.000	.9074E+01	.52739E+03	1.93305	.464842	.78625	44132.2	51846.9	293.240	145.84	173.40	.48621E+00	966	0.00000
490.000	.8972E+01	.52151E+03	1.91495	.447117	.76480	45785.9	53587.6	296.829	147.37	174.75	.51708E+00	952	0.00000
500.000	.8872E+01	.51570E+03	1.89780	.430257	.74460	47452.5	55342.1	300.373	149.02	176.19	.54776E+00	938	0.00000
520.000	.8676E+01	.50428E+03	1.86613	.398961	.70770	50827.8	58896.0	307.342	152.50	179.23	.60830E+00	912	0.00000
540.000	.8484E+01	.49316E+03	1.83756	.370631	.67503	54261.4	62511.7	314.165	156.10	182.36	.66731E+00	888	0.00000
560.000	.8298E+01	.48233E+03	1.81172	.344971	.64614	57754.8	66190.4	320.854	159.73	185.50	.72425E+00	866	0.00000
580.000	.8117E+01	.47180E+03	1.78827	.321712	.62059	61307.9	69931.7	327.417	163.36	188.62	.77886E+00	846	0.00000
600.000	.7941E+01	.46159E+03	1.76690	.300609	.59801	64920.1	73734.6	333.863	166.94	191.67	.83084E+00	828	0.00000
620.000	.7771E+01	.45169E+03	1.74736	.281443	.57805	68590.4	77598.0	340.197	170.45	194.66	.88007E+00	812	0.00000
640.000	.7606E+01	.44212E+03	1.72944	.264013	.56042	72317.5	81520.3	346.423	173.90	197.57	.92647E+00	797	0.00000
660.000	.7447E+01	.43285E+03	1.71293	.248141	.54484	76100.3	85500.1	352.546	177.26	200.39	.96991E+00	784	0.00000
680.000	.7293E+01	.42390E+03	1.69766	.233667	.53110	79937.3	89535.6	358.569	180.53	203.14	.10105E+01	773	0.00000
700.000	.7144E+01	.41525E+03	1.68350	.220447	.51899	83827.1	93625.3	364.496	183.72	205.81	.10483E+01	762	0.00000

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Using a modified version of the nonanalytic equation of state, thermophysical properties of normal butane are derived from physical properties data and are tabulated at integral temperatures from 135 to 700 K along isobars at pressures to 70 MPa. These isobar tables, along with a table for the saturated liquid, give values for densities, compressibility factors, internal energies, enthalpies, entropies, heat capacities, fugacities, sound velocities, dielectric constants, and isochore and isotherm derivatives. Equations, whose coefficients are determined from a least squares fit to selected experimental data, are also presented for vapor pressures, orthobaric liquid and vapor densities, ideal gas properties, second virial coefficients, dielectric constants, heats of vaporization, melting pressures, and orthobaric liquid specific heats, enthalpies, and entropies. Comparisons between experimental and calculated values for all properties considered here are reported in detail.

12. KEY WORDS (Six to twelve entries; alphabetical order; capitalize only proper names; and separate key words by semicolons)

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